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JOURNAL OF EDUCATIONAL RESEARCH

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JOURNAL *of* EDUCATIONAL RESEARCH

Volume XXVIII APRIL 1935 Number 8

THE MEASUREMENT OF TEACHING ABILITY[1]

A. S. BARR
University of Wisconsin

THE Twenty-Third Yearbook[2] of the National Society of College Teachers of Education offers the following comment upon the measurement of teaching ability: "Many of the important and controversial issues in the education of teachers in the United States depend upon knowing in an accurate and detailed way just what constitutes 'successful teaching' in the various kinds of positions, and which characteristics of teachers make them successful. Because of this, all graduate schools and research divisions of educational organizations and foundations should be encouraged to develop a measure or measures of teaching merit and then after the most successful teachers are known, to make the analysis of teaching traits which make for teaching success. The task of measuring teaching success is complicated by so many variables for which there are no satisfactory measures that the problem should become a major research problem, adequately subsidized for a long period of years to test the results of various types of teacher curricula. A hoped-for result from these investigations would be the discovery of one or two tests—simple, short, inexpensive, easily administered, quickly and accurately scored, reliable, and obviously related to teaching—which will measure a teacher's success. With such a measure many troublesome issues could be removed from the controversial group."

More specifically the measurement of teaching ability is important: (1) in the training of teachers in service; (2) in the institutional training of teachers; (3) in the administration of the teaching staff; and (4) in research relating to these fields.

[1] Paper read before a joint session of the American Educational Research Association and the National Society of the College Teachers of Education, at Atlantic City, N. J., February, 1935.

[2] Alexander, Thomas, and others. "The Education of Teachers," The Twenty-Third Yearbook of the National Society of College Teachers of Education (Chicago: University of Chicago Press, 1935), p. 235.

Before turning to the studies of the measurement of teaching ability and to certain suggestions for further research in this field I should like to speak briefly about the contribution of measurements to these four aspects of professional education. In the first place the measurement of teaching ability is important in the training of teachers in service. The supervisor needs carefully validated instruments for the measurement of teaching ability both as an aid to the pre-training diagnosis of teaching and as a means of evaluating the results of training programs. Classroom teachers have become fairly well accustomed to the use of measurements in teaching. It is frequently urged in support of the use of measurements in classroom instruction that to teach most effectively teachers must more accurately measure the results of instruction; to make the instruction more specific teachers must diagnose before teaching, etc. Very much the same claims might also be advanced for the importance of measurement in the professional education of teachers. If the in-service teaching of teachers is to be done as effectively as it should be done, then supervisors must have more adequate instruments for the measurement of teaching ability.

In the second place, the measurement of teaching ability is important in the institutional training of teachers. With the increase in the enrollment of teacher training institutions and the demand for fewer and better trained teachers, those responsible for the institutional training of teachers have been forced to consider ways and means of limiting the number of entrants into teacher training institutions. One of the best and surest means of improving the quality of teaching is to admit to training only those individuals of superior potential teaching capacity.[3] Besides selecting teachers for training, the measurement of teaching ability is of value in the pre-training diagnosis of teaching and in evaluating the effectiveness of training programs, as they are in the in-service training of teachers. To make professional education of teachers most effective those responsible for the institutional training of teachers must measure progress, diagnose, and evaluate the effectiveness of the professional education of teachers as teachers have done in ordinary classroom instruction now for some time. All in all measurement can make an important contribution to the institutional training of teachers.

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[3] Barr, A. S., and Douglas, Lois. "The Pre-Training Selection of Teachers," *Journal of Educational Research*, XXVIII (October, 1934), pp. 92-117.

A third use of the measurement of teaching ability will be found in the administration of the teaching staff. In the first place, some evaluation of the prospective teacher's ability must be made in the selections of teachers. The superintendent has, each year, the important duty of hiring new teachers. The success of his administration in no small measure depends upon his ability to choose capable teachers. In the second place, many school systems pursue the policy of making promotions on the basis of merit; where this policy is pursued, it becomes important that the measures of teaching be valid, reliable, and objective. It also sometimes becomes necessary to decide upon the further retention of teachers; dismissals are sometimes made upon rather flimsy evidence and even upon personal prejudice. Each of these phases of the administrator's work calls for, it seems to me, better measures of teaching ability.

Finally, the measurement of teaching ability is important in research relating to the administration, supervision, and professional education of the teaching staff. There are many problems relating to personnel administration, the in-service and institutional training of teachers, which depend for their solution upon the measurement of teaching ability. Such a problem as the relative merits of textbook courses, observation, and practice teaching in the training of teachers cannot be solved, for example, until the teaching abilities of the teachers trained under different methods of instruction can be accurately measured. Should one desire to evaluate the curriculum of teacher training institutions one would find the task an impossible one in the absence of accurate instruments of measurement. Experimental studies of the methods of the in-service training of teachers are likewise dependent upon the development of accurate instruments of measurement. These and many other problems in the training, administration and supervision of the teaching staff can be solved only by the development of adequate instruments for the measurement of teaching ability.

Now I realize that I have given a disproportionately large amount of space to the discussion of the importance of the measurement of teaching ability, particularly in so short a paper, but it seems to me, inasmuch as the work in this field is relatively new that it is worthwhile to get the problem clearly in mind. If I may, I should like to turn now from this phase of the subject to a brief report of some of the investigations conducted in this field at the University of Wisconsin. We have conducted during the last ten or twelve years a number of

investigations upon one or another phase of the measurement of teaching ability.[4] Because of the shortness of the time for this presentation I shall refer here to only one of the most recent of these investigations.[5] In this investigation we chose for our subjects 99 elementary school teachers teaching in grades two to seven inclusively in five Wisconsin cities. We applied to these teachers, and the pupils taught by them, some nineteen commonly employed instruments of measurement as follows:

(1) Social Intelligence Test, Moss, F. A., Hunt, T., Omwake, K. T., Washington, D. C.: Center for Psychological Service, 1930.

(2) Psychological Examination for High School Graduates and College Freshmen, Thurstone, L. L., and T. G. Washington, D. C.: The American Council of Education, 1929.

(3) The Morris Trait Index L, Morris, E. H., Bloomington, Illinois: Public School Publishing Company, 1929.

(4) Aptitude Test for Elementary and High School Teachers, Bathurst, J. E., Knight, F. B., Ruch, G. M., Telford, F. Washington, D. C.: Bureau of Public Personal Administration, 1927.

(5) New Stanford Arithmetic Test (Form V), Kelley, T. L., Ruch, G. M., Terman, L. M. Chicago, Illinois: World Book Company, 1929.

(6) Professional Information as measured by an unpublished test constructed by Torgerson, T. L., Professor in the College of Education, University of Wisconsin, Madison, Wisconsin, 1930.

(7) Personal Health Standard and Scale, Wood, T. D. New York: Bureau of Publications, Teachers College, Columbia University, 1925.

(8) Personality as measured by an informal ten point scale for the rating of personality.

(9) Vocational Interest Blank, Strong, E. K. Stanford University, California: Stanford University Press, 1927.

(10) Torgerson Diagnostic Teacher Rating Scales of Instructional Activities (Self Ratings), Torgerson, T. L. Bloomington, Illinois: Public School Publishing Company, 1930.

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[4] For a summary of these investigations see: Barr, A. S. *An Introduction to the Scientific Study of Classroom Supervision* (New York: D. Appleton & Company, 1931), XXV + pp. 399.

[5] This investigation was carried on by the writer and Drs. T. L. Torgerson, Earl Johnson, Vergil E. Lyon, and C. A. Walvoord, University of Wisconsin, through the coöperation of the superintendents, principals, supervisors, and teachers of the Antigo, Lake Mills, Marshfield, Marinette, and Stevens Point, Wisconsin, school systems.

(11) Strayer-Engelhardt Teacher Rating Card (Short Form), Albany, New York: C. F. Williams and Son, Inc.

(12) Michigan Education Association Teacher Rating Card (Long Form) Human Scale Method, Lansing, Michigan: Michigan Education Association.

(13) Pennsylvania Teacher Rating Score Card, Harrisburg, Pennsylvania: Commonwealth of Pennsylvania, Department of Public Instruction, Teacher Bureau.

(14) Giles Recitation Score Card, Yonkers-on-Hudson, New York: World Book Company, 1925.

(15) Almy-Sorenson Rating Scale for Teachers, Bloomington, Illinois: Public School Publishing Company.

(16) Schutte Scale for Rating Teachers, Yonkers-on-Hudson, New York: World Book Company, 1923.

(17) Torgerson Diagnostic Teacher Rating Scale of Instructional Activities, (Superintendent Ratings), Bloomington, Illinois: Public School Publishing Company, 1930.

(18) A general merit rating made by the Superintendent of Schools with the assistance of Supervisors and Principals.

(19) The Standard Achievement Test administered to the pupils.

Employing as the criterion of teaching success (1) a composite of the gains in test scores made by pupils during the experimental period on the Stanford Achievement test; (2) a composite of the ratings of the teachers made by the superintendent of schools on seven different rating scales twice applied; (3) a composite of the scores made by teachers on nine measures of qualities commonly associated with teaching success, such as, health, intelligence, personality, professional information, knowledge of subject matter and professional interest; and (4) a composite of all of the foregoing measures, the validity of each of the nineteen instruments of measurement employed in this investigation was studied. While it is not necessary to go into the details of this investigation here, inasmuch as a detailed report of this investigation is to be given elsewhere,[6] in general, the values calculated were exceedingly low, the most of them, when expressed in terms of coefficients of correlations, falling between 0 and .35. It is unnecessary to say that such results for so large a number of more or less typical instruments for the measurement of teaching ability, are, of course, disappointing. While

[6] Lancelot, W. H., Barr, A. S., Betts, G. L., and others. *The Outcomes of Teaching.* New York: The Macmillan Company, 1935.

there are many things to be said about this investigation there is undisputable evidence that there is much more work to be done before we can be said to measure teaching ability accurately. For those who are inclined to say that the measurement of teaching ability is without point, I should like to say before leaving this subject that notwithstanding these very unfavorable results, fourteen of the nineteen instruments of measurements employed in this investigation gave, when judged by the criteria of good teaching used in this investigation, results superior to general merit ratings. If I had time there are other data too that I should be pleased to present showing just how inaccurate our ordinary judgments about teaching ability really are.[7]

I should like to turn now, however, to some of the probable shortcomings in our present approaches to the measurement of teaching ability with the hope that we may be able to offer something constructive to those who care to pursue this matter further. While it is not exactly a shortcoming, the low coefficients of correlation secured in most of the studies of the measurement of teaching ability are due not wholly to the lack of validity in our instruments for measuring teaching ability but in part to errors of measurement; in part to the range of talent; and in part to the minuteness of the contribution made by the different aspects of teaching measured when compared with the whole of teaching ability. I think that these facts are probably worth keeping in mind. The unstable character of the findings, that is, the lack of agreement among investigators, such as we find in the reports of investigations from time to time, is due partly, it seems, to the varying conditions under which the data are collected; to differences in the teachers measured; to differences in the criteria of good teaching employed by different investigators; and to differences in the instrument employed for the measurement of teaching ability in different investigations.

Aside from these statistical considerations there are, however, certain shortcomings in our approaches to the measurement of teaching ability that need to be mentioned. In the first place there is the idea that the teacher's success is determined by her method of teaching or her knowledge of the subject taught. Now, of course, we would all agree, I think, that the knowledge of the subject taught and knowledge of methods of teaching are exceedingly important aspects of teaching, but I think

[7] Barr, A. S. *Characteristic Differences in the Teaching Performance of Good and Poor Teachers of the Social Studies.* Bloomington, Illinois: Public School Publishing Company, 1929.

that we do frequently overlook the fact, however, that the teacher brings into a given teaching situation not merely a knowledge of the subject matter taught or method of teaching but her whole active self. Haggerty has emphasized this fact by stressing the importance of teacher-pupil relationships; others have emphasized this fact by stressing the importance of the teacher's personality. The matter has been expressed differently by different persons, but most any of us who have had any contact with teachers whatsoever know that while a teacher's knowledge of method and subject matter are exceedingly important that they are only aspects of some larger whole not yet very well recognized nor adequately defined.

In the second place most of our present approaches to the measurement of teaching ability are made on the technique level. As I look at the matter, the techniques of teaching are merely the observable superficial aspects of teaching. They are numerous, fleeting and transitory. Within certain limits any one of a number of procedures may serve the teachers' purpose quite as well as another. In making this statement I do not deny, of course, that there is probably for each teaching situation one best technique, but within certain limits, and from a practical point of view, any one of a number of techniques may serve the teacher's purpose about as well as another in most teaching situations. I think that the failure to recognize this fact has lead to a considerable amount of wasted effort in the measurement of teaching ability. In rating, for example, while the observable facts of teaching are specific teacher and pupil activities I think that it is clear that these specific activities are, on the whole, uninterpretable except as they are referred to some more fundamental criteria of good teaching, principles of teaching or what not.

Aside from these needed extensions in our conceptions of teaching, I think that there are certain possible mistakes in our techniques of measurement to which reference should be made in any consideration of methods of improving the measurement of teaching ability. In the first place I suppose that it is generally recognized that there is a rather wide gap between knowledge of how to teach and teaching ability. This, of course, is not a new idea but one that definitely limits the applicability of paper and pencil tests to teaching ability. While I have always favored the application of tests to the measurement of teaching ability I think that it may be necessary to supplement such tests by carefully developed rating scales wherein the data are collected under controlled classroom conditions—something like those under which a Binet test of

intelligence is administered or some other type of controlled observation not yet defined.

In the second place, it seems to me that in our attempts to measure teaching ability we have fallen into the same errors of part measurement into which the early makers of intelligence tests fell. You will recall that the earlier tests of intelligence were not like those so well known today, but single tests of sensori motor processes, auditory and visual acuity, etc. In a manner we appear to fall into the same error in our measurement of teaching ability when we attempt to measure teaching ability through measures of the teacher's health, her intelligence, knowledge of subject matter, method, etc. Probably what we need to do now, is to turn our attention to the development of functional tests measuring the teacher in action. At least I should like to commend this idea to you for consideration.

Leaving this aspect of the subject, I wish to turn now finally, to a few brief comments upon the criteria of teaching success and the collection and statistical treatment of data in investigations of the measurement of teaching ability. In the first place I suppose it goes without saying that it will be necessary to give more attention to the development of the criteria of teaching success. This is, of course, a bit embarrassing inasmuch as there is so little agreement among educationalists as to what good teaching is. I am quite certain that there is available no single test or group of measures of teaching ability as in the field of intelligence testing that may be accepted as an adequate criterion. It seems to me, however, that the ultimate criterion of teaching success will have to be found in the changes produced in pupils measured in terms of the objectives of education. And I think it also goes without saying that these changes or products of instruction will have to be considered broadly. We shall have to take into consideration not merely knowledges and skills and the more tangible outcomes of instruction but attitudes and ideals and the less tangible outcomes of instruction. This in itself presents a very difficult problem for the expert in measurement.

In the second place, I think it will be necessary for us to exercise much more care in the collection of data in the future than we have in the past. I think that the application of the so-called statistical method wherein little or no attention is given to the manner in which the data are collected has proven thoroughly unsatisfactory in the study of the measurement of teaching ability and if better results are to be secured they will be secured through the careful collection of data as in con-

trolled experimentation. This is, of course, no criticism of statistics, but of what I conceived to be a mis-application of statistics. The collection of data and the application of statistical procedure to data are two entirely different matters and no elaboration of either can take the place of the other.

In conclusion, then, I think that we have here an important field of investigation. While a considerable amount of work has been done in the field, the work that has been done has been only moderately successful. In a way, while this work is important, it is, however, only preliminary to the infinite amount of more refined work that needs to be done. In thinking about what needs to be done next, it seems to me then that our approaches to this subject can be improved: (1) through the more adequate use of a number of well known principles and techniques of test construction not here discussed (time does not permit the discussion of many aspects of test and scales construction);[8] (2) by measuring more aspects of the teachers contribution to teaching situations and not merely her knowledge of subject matter, method, or intelligence; (3) by approaching the measurement of teaching ability through functional tests of the whole teacher in action made either through paper and pencil situations tests or through the observation of teachers in controlled teaching situations; (4) by thinking of teaching not so much as so many tricks of the trade, techniques and devices but as the application of fundamental facts and principles to the teaching process; and (5) by the application of better techniques of validation wherein more attention is given to the criterion of good teaching and the condition under which the data for the validation of instruments for the measurement of teaching ability are collected.

[8] Barr, A. S. *An Introduction to the Scientific Study of Classroom Supervision* (New York: D. Appleton & Company, 1931), pp. XXV + 399.

A STUDY OF THE EFFECT OF READING ON SPELLING

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THIS study marks the beginning of an attempt to discover something of the nature of the effect of reading on spelling. It was suggested by a previous investigation[1] which showed that improvement in spelling takes place during the high-school and college years. Since systematic instruction in spelling is no longer given at these levels, what is to account for the improvement? No doubt there are several operative factors. It would appear that a most important one is the learning which occurs as a by-product of reading.

The present report covers an experiment with three hundred eighty men and women students of junior, senior and graduate university levels. It is concerned chiefly with three questions: Does reading for the purpose of being able to answer questions on the context result in any improvement in spelling for words encountered in the selection? Do good spellers surpass poor spellers in the amount of learning in spelling acquired through reading? Is improvement in spelling effected by virtue of a slow reading rate?

In preparation for the experiment a list of thirty-nine difficult words was selected from a number of books in which college students might be expected to be interested. Although no reference was made to word counts, no word was included which was considered entirely foreign to the vocabulary needs of university upperclassmen. To this list there were added eleven of the most difficult words from the Sixteen Spelling Scales.[2] The fifty-word tests was administered to a trial group of one hundred forty-eight students. On the basis of their spellings the twenty most difficult words were identified. They were matched approximately for difficulty into two sets of ten words each.

The general plan was to pre-test the students on both sets, present a reading selection in which were embedded the words of only one set, then post-test on both sets to compare the learning that had taken place. As a check against the possible influence of the inequality of difficulty

[1] Gilbert, L. C. *An Experimental Investigation of Eye Movements in Learning to Spell Words.* Psychological Monographs, No. 196, Princeton: Psychological Review Publications, 1932.

[2] *Teachers College Bulletin*, "Sixteen Spelling Scales, Standardized in Sentences for Secondary Schools," New York: Bureau of Publications, Teachers College, Columbia University, 1921.

Set I	*Set II*
psittacosis	cachexy
tachistoscope	sycee
misogyny	synecdoche
myxedema	anopheles
paean	empyema
cinchona	viosterol
chalcedony	sycophant
acanthaceous	churr
ecchymosis	autochthonous
tachygrapher	pteridophyte

of the two sets of words, both were embedded in reading selections and given to different groups of students. The selections were of prose, composed with the purpose of interesting college students. They were similar in character and length. The one contained 715 words, the other 702 words. All of the material was mimeographed.

For pre-testing purposes the two sets of key words were dictated in chance order as part of the full fifty-word test. This procedure had a threefold value: it yielded fifty-word test results which made possible the relative classification of students according to spelling ability; it made the key words less conspicuous than they would have been in a shorter test and therefore less easily recognizable in the reading selection which followed; and it measured the ability of the subjects to spell the individual key words. Each of the fifty words was pronounced first, then given in a sentence, and then pronounced alone again. For all groups the same person dictated the words for both pre-test and post-test.

Although with two groups of students the reading selection followed the spelling pre-test immediately, the directions gave no intimation of any connection. The students were told to read the selection at their normal reading rate with a view to answering questions on the context later. They were told not to re-read, but to turn the paper over immediately after one reading. When the slowest reader had finished, all papers were collected and mimeographed sheets bearing ten true-false questions on the context were distributed. It was not until after the true-false questions were answered that the students were requested to turn over the papers and were informed that they were to take another spelling test. At this time only the twenty words of the two key sets were dictated.

The procedure just described was used with two experimental groups. With a third group certain variations were introduced. A timing technique was employed to study rate of reading. The same directions were given as with Groups A and B except that the students were told that at the command "Mark" they were to encircle the word they were reading at the moment. The instructor gave the command at thirty-second intervals. This is obviously a crude measure of rate, but is sufficient to give an indication of what might be found with a more refined technique. The second variation was designed to check the effect of re-encountering immediately in reading words just encountered in a spelling test: the pre-test was given to Group C three weeks before the reading selection. Aside from these two changes the procedure was the same as for Groups A and B.

FINDINGS

The average number of words correctly spelled on the full fifty-word pre-test and on the selected key words is shown for Groups A and B in Table I. Since the preliminary test was not standardized it is impossible to determine how these groups compare with other adult spellers of college level. The data, however, render possible relative ability groupings and comparisons. The approach to equality of performance for the corresponding ability sections of Groups A and B is surprisingly close. The key words of Set I appear slightly more difficult for both groups than those of Set II. The difference did not appear sufficient, however, to warrant a change, especially in view of the fact that the two sets of words alternated experimental and control roles with the two different student groups.

TABLE I

MEAN NUMBER OF WORDS CORRECTLY SPELLED ON PRE-TEST BY GROUPS A AND B DIVIDED INTO FOURTHS ACCORDING TO SPELLING ABILITY

Section	Number of Students	Mean Number of Words		
		Pre-Test (50 Words)	Key Words in Set I (10 Words)	Key Words in Set II (10 Words)
Group A:				
Best fourth	30	28.77	2.37	2.30
Second-best fourth	30	22.13	1.40	1.20
Third-best fourth	30	18.93	1.37	.63
Poorest fourth	30	12.77	.37	.30
Entire group	120	20.65	1.38	1.11
Group B:				
Best fourth	37	29.22	2.57	2.51
Second-best fourth	37	23.70	1.35	1.14
Third-best fourth	37	19.00	1.19	.57
Poorest fourth	37	13.24	.59	.51
Entire group	148	21.29	1.43	1.18

The presentation of scores for the true-false questions on the reading selections is not regarded as essential. No student made more than three errors out of a possible ten. Apparently the selections were well enough understood for the purposes of this investigation.

TABLE II

MEAN PERCENTAGE OF POSSIBLE SPELLING GAIN MADE BY GROUPS A AND B DIVIDED ACCORDING TO SPELLING ABILITY ON FIFTY-WORD PRE-TEST

	Words in the Reading Test (Set I)	Words in the Reading Test (Set II)
Group A:		
Number of students, 120		
Mean gain	33.4	3.7
Standard Deviation	21.6	13.4
$M_r - M_n = 33.4 - 3.7 = 29.7$		
P. E. of Mean Difference = 1.6		
Group B:		
Number of students, 148		
Mean gain	32.6	3.1
Standard Deviation	25.1	8.1
$M_r - M_n = 32.6 - 3.1 = 29.5$		
P. E. of Mean Difference = 1.5		

Table II presents the results for the immediate recall groups on the post-tests for the key words. Only total corrections were considered in computing gain. Improvement is expressed in terms of percentage of possible gain. That is, if a student missed six words on the pre-test, and three words on the post-test, he made 50 percent of all the gain that was possible.

An interesting phenomenon is the gain accruing for words not encountered in reading. It is slight, to be sure, but is present for both groups. Since the same person pronounced both tests and since there was no opportunity to look up spellings in the interim between pre-test and post-test, the gain must be attributed to the advantage resulting from hearing the words pronounced a second time, or to the fact that the post-test was shorter than the pre-test.

For both groups the gain for the words encountered in reading is markedly superior to that for words not encountered. Although different sets of key words were used in the reading selections both groups approximated one-third of all the gain that was possible. Since the actual difference between the mean gains for the words encountered in reading and the words not encountered in reading are nineteen times (Group A) and twenty times (Group B) the Probable Error of the Mean Differences, the gains must be regarded as statistically significant.

Table III analyzes the learning achievement according to the spelling ability of the students. For the words not seen in the reading the gain

shows no correspondence with ability. On the other hand the table indicates that for both groups the good spellers surpass the poorer spellers in the amount which they acquire through encountering words in reading. The best fourth of Group A was 159 percent as effective as the second-best fourth; it was 204 percent as effective as the third-best fourth, and 276 percent as effective as the poorest fourth. In Group B the best fourth was 130 percent as effective as the second-best fourth, 165 percent as effective as the third-best fourth, and 254 percent as effective as the poorest fourth.

TABLE III

MEAN PERCENTAGE OF POSSIBLE GAIN MADE BY GROUPS A AND B DIVIDED ACCORDING TO SPELLING ABILITY ON FIFTY-WORD PRE-TEST

Section	Number of Students	Words Encountered in Reading		Words Not Encountered in Reading		Difference Between Means	Probable Error of Mean Difference
		Mean Gain	Standard Deviation	Mean Gain	Standard Deviation		
Group A:							
Best fourth	30	53.8	21.3	4.0	16.3	49.8	3.3
Second-best fourth	30	33.8	19.8	4.8	15.7	29.0	3.1
Third-best fourth	30	26.4	14.8	1.8	10.9	24.6	2.3
Poorest fourth	30	19.5	13.5	4.4	8.8	15.1	2.1
Group B:							
Best fourth	37	48.2	26.2	1.4	8.9	46.8	3.5
Second-best fourth	37	37.0	17.2	4.5	7.5	32.5	2.1
Third-best fourth	37	29.2	19.9	4.5	9.0	24.7	2.7
Poorest fourth	37	19.0	13.3	1.9	6.1	17.1	1.6

The tables which follow present the data for the third group, Group C. The students in this group, it will be recalled, marked their progress in reading at thirty-second intervals: their reading selection was not given until three weeks after the spelling pre-test.

TABLE IV

MEAN NUMBER OF WORDS CORRECTLY SPELLED ON THE PRE-TEST BY GROUP C

	Number of Students	50-Word Pre-Test	10-Word Pre-Test Words Seen in Reading	10-Word Pre-Test Words Not Seen in Reading
Best fourth	28	31.54	1.64	1.64
Second-best fourth	28	28.10	.96	.79
Third-best fourth	28	25.75	.39	.64
Poorest fourth	28	19.61	.18	.36

Table IV shows the mean number of words correctly spelled on the pre-test. Neither key set proved consistently harder than the other for all four sections of this group.

TABLE V

MEAN PERCENTAGE OF POSSIBLE SPELLING GAIN MADE BY GROUP C

	Words in the Reading Test (Set I)	Words not in Reading Test (Set II)
Number of students, 112		
Mean gain	15.5	1.0
Standard Deviation	15.8	11.9

$M_r - M_n = 15.5 - 1.0 = 14.5$

P. E. of Mean Difference = 1.2

Table V shows the average gain in spelling attained through the reading selection which was given three weeks after the spelling pre-test. The improvement amounts to something less than half of that realized by the groups taking the pre-test and the reading during the same hour. A part of this difference is due probably to the three-week delay, but it is also probable that marking the selection at half-minute intervals constituted a distraction which militated against learning. From these data it is impossible to determine the extent of the influence of each of the two variables. Nevertheless, despite delay and distraction the residual gain amounted to 16 percent of all that was possible. The gain is statistically significant since the difference between the mean gains amounts to thirteen times the Probable Error of the Mean Difference.

TABLE VI

MEAN PERCENTAGE OF POSSIBLE GAIN MADE BY GROUP C DIVIDED ACCORDING TO SPELLING ABILITY ON FIFTY-WORD PRE-TEST

Section	Number of Students	Words Encountered in Reading		Words Not Encountered in Reading		Difference Between Means	Probable Error of Mean Difference
		Mean Gain	Standard Deviation	Mean Gain	Standard Deviation		
Best fourth	28	24.1	17.9	−.9	16.8	25.0	3.1
Second-best fourth	28	19.5	16.7	1.4	10.1	18.1	2.5
Third-best fourth	28	11.3	12.2	2.5	9.4	8.8	2.0
Poorest fourth	28	7.2	8.6	1.2	9.1	6.0	1.6

Table VI analyzes the gain for Group C in terms of ability fourths. For every level of ability the gain is significantly greater for words seen

TABLE VII

READING RATES OF FOUR SECTIONS OF GROUP C DIVIDED ACCORDING TO SPELLING ABILITY ON FIFTY-WORD PRE-TEST

Section	Number of Students	Mean Number of Words Read a Minute	Standard Deviation
Best fourth	28	283.7	33.82
Second-best fourth	28	273.0	65.59
Third-best fourth	28	264.4	52.95
Poorest fourth	28	273.4	59.67

in reading than for words not seen. Each ability section surpasses in gain the poorer ability sections.

TABLE VIII

SUPERIORITY IN READING RATE OF GOOD SPELLERS OVER LESS GOOD SPELLERS (RATE EXPRESSED IN NUMBER OF WORDS PER MINUTE)

	Actual Difference of Means	P. E. of M. Difference
Best fourth over second-best fourth	10.7	9.38
Best fourth over third-best fourth	19.3	8.09
Best fourth over poorest fourth	10.3	8.83

Tables VII and VIII are concerned with the rate of reading averaged by the four spelling ability sections of Group C. For all the sections there were large deviations from the average. Inspection of the mean differences and their probable errors indicates that no one ability group surpassed any other in reading time by any significant amount. It would appear that a slow rate of reading is not an essential ingredient in effecting improvement in spelling through reading.

SUMMARY

The findings of this experiment indicate clearly that college students improve their spelling through reading even when attention is not directed toward that end. No doubt the amount of gain is influenced by the type of reading and by the purpose of the reader: proof of this hypothesis constitutes an inviting objective for further study.

The pick-up through reading for words recently brought to the individual's attention is probably greater than the pick-up for words encountered more remotely. But even for words which have not recently been brought to mind the amount of learning through reading is highly significant.

Good spellers are able to pick up more spelling through their reading than poor spellers.

Apparently this superior achievement is not effected by virtue of a slow reading rate for the good spellers. The data show large deviations from the average rate for both good and poor spellers. There is no significant difference in the reading rates of those who acquire little spelling and those who acquire much.

PROGNOSTIC VALUE OF INTELLIGENCE TESTS

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SINCE the introduction of intelligence tests into the field of education, there has been much discussion, pro and con, as to their value to teachers and school administrators. The opinions advanced range all the way from attributing to them little or no value at all to that of considering them of great value in homogeneous grouping and prognosticating high school and college successes. The only logical test of these extreme theories lies in checking them with concrete data over an extended period of time.

With the Freshman class entering West Newton High School in 1921 was inaugurated the practice of administering to each entering class an intelligence test upon its entrance to high school. For a period of ten years, 1921-1931, this practice has continued and records for eleven classes, numbering 1146 pupils, have been examined. In studying these records, two questions arose: 1. Do these test scores or results indicate any prognostic value whereby the pupil's ability or success in pursuing

TABLE I

THE NUMBER AND PERCENTAGE OF PUPILS WHO ARE ADMITTED AND WHO DROP OUT AT EACH IQ LEVEL

I Q	Number Admitted	Percent Admitted	Number who drop out	Percent who drop out
131+	3	.3	0	0
128–130	4	.4	0	0
125–127	7	.6	1	14
122–124	19	1.7	1	5
119–121	37	3.2	1	3
116–118	49	4.3	1	2
113–115	56	5.0	2	3.5
110–112	59	5.0	3	5
107–109	71	6.2	6	8
104–106	98	8.5	12	12
101–103	110	9.6	19	17
98–100	122	10.6	27	22
95– 97	106	9.2	34	32
92– 94	97	8.5	51	53
89– 91	91	8.0	55	60
86– 88	77	6.7	53	69
83– 85	64	5.6	35	55
80– 82	35	3.0	25	71
77– 79	21	1.8	13	62
74– 76	10	.9	7	70
71– 73	6	.5	4	67
68– 70	4	.4	3	75

the several high school subjects might be predicated? 2. Do they show any trends in indicating the length of time a pupil is likely to remain in high school?

It is true that there is no sampling of various types of high schools in this study, but the extended period of time covered and the number of cases involved should add to the significance of the findings. Of the eleven classes included in the study, four, 1921, 1922, 1923, and 1924, were given the Terman Group Test of Mental Ability, Form A, while the remaining seven classes were given the Otis S. A. Intelligence Test, Form A. The techniques of the authors were closely followed in transmuting the scores to IQ's. The number of pupils admitted during the period and the number who have dropped out of high school, classified according to their IQ's are given in Table I.

Of the total number who dropped out of high school during this period, 60 percent did so during their first year in attendance, 28 percent during their second year, 10 percent during their third year, and only 2 percent during the fourth year. Figure 1 gives a graphic representation of the data.

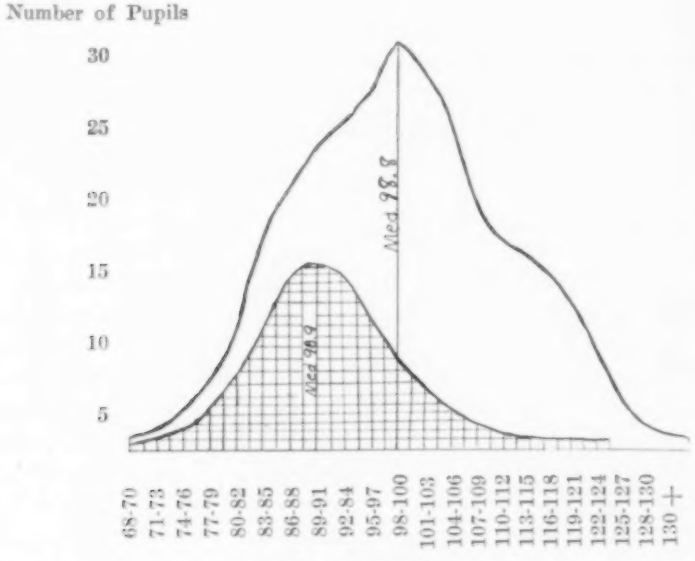

FIGURE 1

THE LARGE GRAPH REPRESENTS THE TOTAL NUMBER OF PUPILS ADMITTED TO HIGH SCHOOL. THE SHADED GRAPH REPRESENTS THE TOTAL NUMBER WHO DROPPED OUT BEFORE COMPLETING THE COURSE

The median IQ for the group that dropped out of high school before the completion of the course is 90.9. The length of time that the group above and the group below this median remained in high school is shown in Table II.

TABLE II

THE LENGTH OF TIME THAT PUPILS ABOVE AND BELOW AN IQ OF 90.9 REMAIN IN HIGH SCHOOL

	Percent with I Q above 90.9	Percent with I Q below 90.9	Time of dropping out
	55	66	During first year
	31	25	During second year
	12	8	During third year
	2	1	During fourth year
Total	100	100	

The above table shows that for the group who dropped out of school, 55 percent of those with IQ's above 90.9, the median for the group who dropped out, dropped out during their first year in attendance and 66 percent of those with IQ's below this median dropped out during the same period of time.

TABLE III

THE PERCENT OF FAILURES FOR ALGEBRA AND ENGLISH AT DIFFERENT IQ LEVELS

I Q's	Percent of Failures in Algebra	Chances to pass Algebra	Percent of Failures in English	Chances to pass English
122+				
120–121				
118–119				
116–117				
114–115				
112–113				
110–111				
108–109	7		0	
106–107	8		0	
104–105	1		0	
102–103	5	19 out of 20	7	13 out of 14
100–101	13	7 out of 8	6	
98– 99	33	2 out of 3	6	
96– 97	16		10	
94– 95	25	3 out of 4	13	
92– 93	33		20	4 out of 5
90– 91	46	1 out of 2	18	
88– 89	46		12	
86– 87	40		14	
84– 85	57		20	
82– 83	66	1 out of 3	20	
80– 81	50		50	1 out of 2
78– 79	50		33	
76– 77	80	1 out of 5	36	
74– 75	100	No chance	100	No chance

Of the total number entering high school with IQ's above the Median, 98.8 (group 98-100), 513 pupils in all, only 46 or 9 percent dropped out, while of those who entered with IQ's below this median, 511 in all, 55 percent dropped out. This means that a pupil with an IQ above 98 has six times as many chances to remain in high school and finish as the pupil with an IQ below 98.

In the light of such marked relations between low IQ's and school "drop outs" the question arose whether there was any relation between low IQ's and special subject failures. The record of pupil failures for the same period of time in the subjects of Algebra and English together with pupil IQ's is given in Table III. In this study, a failure is interpreted as having failed the subject for one or more semesters.

It is plainly evident that there are variations in the percentages of failures as the value of the IQ decreases, but this is just what might be expected. The fact remains that, in general, the percentages of failures increase as the value of the IQ decreases.

CONCLUSIONS

It is evident that the sampling in this study is somewhat narrow since it has been limited to a single high school, but the period of time involved should add to the significance of the findings. In the light of the above, so far as conclusions are valid, the following might be drawn:

1. A pupil who scores in the middle fifth of the class on the intelligence test administered when he enters high school has three times as many chances of remaining in high school until he finishes the work as one who scores in the lower fifth; while a pupil in the upper fifth has twenty-one times as many chances to remain as one who scores in the lower fifth.

2. Of those who drop out before they finish the course, 60 percent do so the first year, 28 percent the second year, 10 percent the third year, while only 2 percent remain for part of the fourth year.

3. Pupils with an IQ of 100 or above are almost certain to pass the subject of Algebra.

4. An Otis IQ of 100 or better gives almost perfect assurance of a passing grade in English.

5. Pupils with IQ's of 90 or below should not be encouraged to pursue a course in Algebra.

6. If pupils of low IQ's are to remain in high school and profit by the instruction given there, special arrangements of subject content must be made to meet individual differences.

7. If high school administrators could be made to realize that those pupils who score in the lower fifth of the class, as measured by intelligence tests at the beginning of their high school course, had a handicap of twenty-one times as many chances to drop out without finishing the course as those who rank in the highest fifth, there might be more concern and greater effort to adjust courses and take care of those differences.

SOME RELATIONSHIPS BETWEEN INTELLIGENCE AND ACHIEVEMENT IN THE PUBLIC SCHOOL

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INTRODUCTION

This study deals with some relationships between intelligence and achievement in the public school. It is concerned not so much with these relationships themselves as with their possible use in indicating significant educational problems. Throughout the study, for reasons that are set forth later, intelligence has been assumed to be that which is measured by the National Intelligence Test, and achievement that which is measured by school marks.

Since the appearance of standardized group tests, which made possible rapid surveys of large numbers of children, the general relationship between intelligence and achievement has received a great deal of attention. Extensive investigations have considered such problems as the classification of pupils, for example, those of Terman (19), McCall (12), Pintner and Noble (14); the overlapping of intelligence from grade to grade, Kruse (9), Kelley (8), Madsen (10), Burt, (4); the standard of intelligence required for the work of particular grades, Terman (20), Brooks (3), Hart (6); and exceptional children, Horn (7), Wallin (23), Terman (21), Stedman (17). Of the studies that have examined the relationship by means of the techniques of correlation, several have been at the high school level, Book (2), Procter (15), Madsen (11), Miller (13), Shewman (16); while only three appear to be outstanding in the field of public school education, Burt, (4), Gates (5), St. John (18). In all three cases, however, and particularly with the first two, the major emphasis seems to have been upon the degree of relationship between intelligence and achievement, with but little attention to the causes of the discrepancy as reflected in the size of the correlation coefficient.

Our present concern is not so much with the actual degree of correlation between intelligence test scores and school marks, as with the factors influencing the correlation. These are undoubtedly many and varied. But those that are of chief significance to education might conceivably be illuminated or thrown into relief if we consider the conditions under which the correlations vary regularly and markedly.

PROCEDURE

The 524 children used as subjects in this research were pupils in Grades II to Senior Fourth at Regal Road Public School, Toronto.[1] *The National Intelligence Test* was administered during the period from November 15 to December 10, 1932, and school examinations in the various branches of the curriculum were conducted by the teachers as usual. For purposes of obtaining a suitable measure of achievement, as judged by the teachers themselves, the October and December examination marks were averaged.

TREATMENT OF DATA, AND RESULTS

Coefficients of correlation (Pearson r) were calculated between National scores and school marks by grades. In doing this, the results for different rooms at the same grade level were combined by transposing both the intelligence scores and total school marks into deviation units, based on the averages and standard deviations for the rooms. The following values were obtained:

Grade	No. of classrooms	No. of pupils	r (National-School Marks)
Sr. IV	3	124	.47 (p. e. .05)
Jr. IV	3	91	.15 (p. e. .07)
Sr. III	3	119	.39 (p. e. .05)
Jr. III	4	129	.46 (p. e. .05)
II	2	61	.57 (p. e. .06)

It will be noted that an interesting trend appears in the correlation coefficients. The highest value occurs at Grade II, after which there is a gradual decrease until Junior IV, where the lowest value is obtained. In Grade Senior IV, the correlation becomes significant again. This trend does not seem to depend directly upon an underlying variation in the reliability of the scores; for the results of correlating the October and December marks (deviation units) of the five grades concerned, and the odd and even sub-tests, (National Scale), were as follows:

Grade:	Sr. IV	Jr. IV	Sr. III	Jr. III	II
Correlation October-December Marks:	.67	.70	.64	.71	.65
Odd-Even Sub-tests (National):	.78	.80	.84	.77	.72

[1] The Toronto public school system includes seven grades above the kindergarten, called respectively Junior First, Senior First, Second, Junior and Senior Third, Junior and Senior Fourth. These are approximately equivalent to Grades 1 to 8 in American elementary schools, in that they precede secondary education.

Nor does the trend in the correlations (intelligence versus achievement) seem to be accounted for by the variations in range of talent or number of cases in the different grades; for it will be remembered that standard scores were used, which were based upon grade-populations approximately equivalent in mental-age spread.

Before proceeding further with the search for factors which might illuminate the trend exhibited by the correlations, it is interesting to check the trend by more detailed analysis of the achievement records. For this purpose, the results in the school-subjects separately were correlated with National scores, and with each other. For the sake of brevity, we quote the correlation coefficients obtained with one room from Grade Senior IV. The unquoted rooms gave values that are entirely similar as far as this treatment of data is concerned.

SENIOR IV

	1. Arithmetic	2. Geography	3. Composition	4. Reading	5. Spelling	6. National
1	...	.76	.57	.10	.51	.32
2		...	.62	.48	.64	.50
3			...	.60	.60	.26
4				...	.34	.48
5		(Average Coefficient: 0.47)			...	.29
6						...

The average coefficients showed the same trend as before, the values being: Sr. IV, .47; Jr. IV, .29; Sr. III, .34; Jr. III, .42; II, .46. Similarly, by Thurstone's Multiple Factor Analysis (22), the average weightings of Factor I were respectively .75, .64, .67, .72, .74.[2]

We may, therefore, conclude that in this particular school, and at the time of our experiment, the relationship between *g* and achievement-standards varies from grade to grade in the manner suggested by the first-quoted correlations. We speak here of *g*, since our second analysis of the results (by Thurstone's technique) is independent of any attenuating influences inherent in the National test; and we accept school-marks as indicators of achievement, because we are interested

[2]By Thurstone's technique, the data quoted in the above table reveal the presence of a factor general to the table; but the technique does not seem to be adequate in this case to a more detailed analysis of the results. It was observed that by Spearman's tetrad-differences method, an occasional group factor showed itself. But since we are here concerned only with the major relationship between intelligence and achievement, we are reserving the further treatment of group-factors involved for discussion in another connection.

particularly in the demands made by the school, rather than in the actual knowledge acquired by the pupils.

In endeavoring to interpret this finding, we may turn first to the records of behavior in the classroom. These records, kept under the direction of the Toronto Research Division, Canadian National Committee for Mental Hygiene, have been described in a previous publication (1). They include the reports by teachers concerning any 'misdemeanors' committed by the children during class periods, a 'misdemeanor' being defined as any action necessitating the interruption of the classroom proceedings. Among the categories used in classifying these misdemeanors, some few, such as 'disobedience,' 'inattention,' 'lack of application,' seem to have an obvious relation to school work; and the number of incidents pertaining to these categories was compared with the total number of reported incidents per grade, during the current school year. Expressed as percentages, (Column 5) the results were:

Grade	No. of pupils	Average per pupil Selected Misdemeanors	Average per pupil Total Misdemeanors	Percentage
Sr. IV	140	.050	.157	31.8
Jr. IV	141	1.021	1.206	84.7
Sr. III	157	.828	1.000	82.8
Jr. III	186	.349	.451	77.4
II	95	.200	.505	39.6

These percentages (column 5) show an increase in the relative frequency of misdemeanors reflecting disinterest in school work, from Grade II to Grade Junior IV. The value for Grade Senior IV then drops considerably. It may, therefore, be that the varying degree of correlation between g and achievement is indicative of underlying variations in motivation; for it will be observed, the trend of the percentages here presented is inversely related to the trend of the correlations under consideration.

Lest the presence of pupils who repeat one or more grades should be exerting an influence on the results, it was decided to examine such cases in the following manner. For each classroom, the scores on the National Test were distributed and converted into sigma units. Similar conversion was effected with the total school marks. The degree of 'disparity' between intelligence score and achievement was then represented for each pupil by the difference between the two values thus obtained. If a child's achievement score was greater than his intelligence score, the disparity value was called 'positive;' if less, 'negative.' The

disparity value of each child who was repeating his present grade was thus available; and in addition, the disparity values of all children who had ever repeated a grade were studied.

There were nine cases in Grade II, who were repeating that grade; and these showed an average positive disparity of only .20. In Grade III, the corresponding values were 11 and .49. Only two cases were repeating Senior III, and only four were repeating Junior IV, the average disparity of these latter being plus .31. In Senior IV there were twenty repeaters, but their average disparity was minus .38. For those children who had at some time repeated a grade, the values were: Grade II, 29 cases, average disparity .10; Grade Junior III, 54 cases, .01; Grade Senior III, 41 cases, minus .04; Grade Junior IV, 33 cases, minus .11; Grade Senior IV, 58 cases, minus .11. These figures indicate that mere repetition of the grade and the possible consequent cloaking of *g* by reproduction, in no way explains the variations in the correlations.

Examination of the disparity values of all children tested revealed little that is pertinent to the present problem. There appeared to be a sex difference, in that, in each grade, and particularly at the Senior IV level, the girls showed positive disparity predominantly, while the boys were more usually achieving less than their intelligence scores would suggest. With 'problem cases' — children who had been reported at some time to the school clinic for intensive study,—the tendency was towards negative disparity.

As a tentative conclusion, therefore, we may say that the underlying cause of the varying degree of correlation between *g* and school achievement, appears to pertain to the efficiency of the motivation manifested in the educational practices. Interest in the work of the school would thus seem to decrease, particularly with boys, from Grade II onwards, so that individual differences in interest play a marked part in determining the efficiency as judged by school standards. At Senior IV, the situation is more generally stimulated by the high school entrance examination, so that peculiarly individual attitudes play a lesser part. If this interpretation is warranted, it would seem that the correlation between *g* and achievement offers a great deal as a technique of studying the efficiency of educational procedures. A high correlation would not necessarily indicate excellence in educational value, but would at least point to the efficiency of the practices employed. In the situation here examined, we feel justified in suggesting that at least our results point to the need of more adequate motivation as puberty approaches,—moti-

vation that may possibly be very difficult to secure without such administrative changes as are involved in establishing intermediate schools, or a radically different philosophy underlying the curriculum of the upper elementary grades.

SUMMARY

The relationship between intelligence test scores and achievement in school has been examined by means of data in a public school. The variations shown as the grades progress seem to indicate changes in the degree to which school procedures offer a generally stimulating atmosphere. The results suggest the possible significance of this relationship in evaluating some broad educational policies.

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EQUATING INTELLIGENCE QUOTIENTS FROM GROUP TESTS

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MILLER[1] writing soon after group intelligence tests came into common use in the public schools, pointed out that a wide variation might exist in results from different tests, and, as a means of meeting the practical problem created by this variation, constructed a graph from which the S-B equivalent of ten common group tests could be read. More recently Kefauver[2] published a table of values obtained from Miller's graph and added at the same time figures for the Otis tests. While this table provides in very convenient form a basis for combining results from different tests, it is unfortunately derived from data on only 57 cases, and therefore is not as accurate as might be desired, since on a group of this size the probable errors of both the means and the standard deviations of the various distributions are appreciable. Furthermore, the subjects were not tested with all tests at the same time, but instead a period of almost a year elapsed between the administration of certain of the tests. In the case of those students having high mental ages, there would be a tendency for the later intelligence quotients to be too low because of the limitations of the tests employed.

The writer has collected for five group tests commonly used at the high school level data from which has been derived a table of values in which errors from the two sources noted are reduced in magnitude. Records on 621 students, each of whom was tested with all five tests at the time of his entrance to University High School, University of

TABLE I

MEANS AND STANDARD DEVIATIONS OF INTELLIGENCE QUOTIENTS OBTAINED FROM VARIOUS TESTS

	N = 621		Miller — N = 57	
	M	σ	M	σ
Army Alpha 8	122.03	14.53	123.3	14.7
Haggerty Delta 2	127.55	17.94	127.8	19.0
Miller A	132.54	21.8	131.0	22.9
Pressey Sr. Class	117.82	15.75	119.7	16.6
Terman A	119.3	13.33	117.1	13.0

[1]Miller, W. S. "The Variation and Significance of Intelligence Quotients Obtained from Group Tests," *Journal of Educational Psychology*, XV (1924), pp. 359-366.

[2]Kefauver, Grayson N. "Need of Equating Intelligence Quotients Obtained from Group Tests," *Journal of Educational Research*, XIX (1929), pp. 92-101.

TABLE II

EQUIVALENT GROUP TEST INTELLIGENCE QUOTIENTS

Terman A	Army Alpha 8	Delta 2	Miller A	Pressey Sr. Class
66	64	56	46	55
67	65	57	47	56
68	66	59	49	58
69	67	60	51	59
70	68	61	52	60
71	69	63	54	61
72	70	64	56	62
73	71	65	57	64
74	72	67	59	65
75	74	68	61	66
76	75	69	62	67
77	76	71	64	68
78	77	72	65	69
79	78	73	67	71
80	79	75	69	72
81	80	76	70	73
82	81	78	72	74
83	82	79	74	75
84	83	80	75	77
85	85	82	77	78
86	86	83	78	79
87	87	84	80	80
88	88	86	82	81
89	89	87	83	82
90	90	88	85	84
91	91	89	87	85
92	92	91	88	86
93	93	92	90	87
94	94	94	91	88
95	95	95	93	90
96	97	96	95	91
97	98	98	96	92
98	99	99	98	93
99	100	100	100	94
100	101	102	101	95
101	102	103	103	97
102	103	104	105	98
103	104	106	106	99
104	105	107	108	100
105	106	108	109	101
106	107	110	111	103
107	109	111	113	104
108	110	112	114	105
109	111	114	116	106
110	112	115	118	107
111	113	117	119	108
112	114	118	121	110
113	115	119	122	111
114	116	121	124	112
115	117	122	126	113
116	118	123	127	114
117	119	125	129	116
118	121	126	131	117
119	122	127	132	118

Terman A	Army Alpha 8	Delta 2	Miller A	Pressey Sr. Class
120	123	128	134	119
121	124	130	135	120
122	125	131	137	121
123	126	133	139	123
124	127	134	140	124
125	128	135	142	125
126	129	137	144	126
127	130	138	145	127
128	131	139	147	129
129	133	141	149	130
130	134	142	150	131
131	135	143	152	132
132	136	145	153	133
133	137	146	155	134
134	138	147	157	136
135	139	149	158	137
136	140	150	160	138
137	141	152	162	139
138	142	153	163	140
139	143	154	165	142
140	145	156	166	143
141	146	157	168	144
142	147	158	170	145
143	148	160	171	146
144	149	161	173	147
145	150	162	175	149
146	151	164	176	150
147	152	165	178	151
148	153	166	180	152
149	154	168	181	153
150	155	169	183	155
151	156	170	184	156
152	158	172	186	157
153	159	173	188	158
154	160	174	189	159
155	161	176	191	160
156	162	177	193	162
157	163	178	194	163
158	164	180	196	164
159	165	181	197	165
160	166	182	199	166
161	167	184	201	168
162	168	185	202	169
163	170	187	204	170
164	171	188	206	171
165	172	189	207	172

Minnesota, have been employed.[3] While age at test has not been uniform for all these subjects, in general they have been within the age range for which tests were designed. The means and standard deviations reported indicate the extent to which the group differs from an average high school student body. Table I permits a comparison of the present results with those reported by Miller.

[3]Records on 224 cases were made available for this study through the courtesy of Professor W. S. Miller of the College of Education, University of Minnesota.

To obtain the values in Table II a graph similar to Miller's was constructed. The points of intersection indicated where any pair of tests give directly comparable results. Using the ratio between the pairs of standard deviations involved, and the points of reference obtained from the graph, the complete sets of values were computed. These values were checked against the graphs at various points to insure accuracy.

While there is a close similarity of results from the two sets of data, point for point, comparisons at various levels indicate differences of magnitude that might well be taken into account when combining results from different tests.

DETERMINATION OF GRADE PLACEMENT OF HISTORY MATERIAL

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An article published last year in this Journal[1] showed that the texts in social studies written by Dr. Harold Rugg of Columbia University offered less vocabulary difficulty to students than did the history, geography and civics books that they displaced in one junior high school. The data offered in proof of this were obtained by application of the technique of Vogel and Washburne.[2]

Vogel and Washburne offer an objective method of gathering data to determine the grade placement of children's reading material, and to the data thus obtained apply a regression equation. In brief, they take a thousand word sampling from the book being examined. In the sample taken they determine the number of different words, the number of prepositions, and the number of words not found in Thorndike's (10,000) Word List. Further, they find the number of simple sentences in a sampling of seventy-five sentences from the text. To this data is applied the following regression equation:

$$X_1 = .085X_2 + .101X_3 + .604X_4 - .411X_5 + 17.43$$

X_1 is the reading score needed to understand the text; X_2 the number of different words in 1,000; X_3 the number of prepositions in the 1,000-word sample; X_4 the number of uncommon words (not in Thorndike) in the 1,000; and X_5 the number of simple sentences in 75.

Any determination of the reading difficulty of a history book based on a 1,000 word sample is certainly open to question. In most history texts for the middle grades and junior high school, such a sample constitutes about one percent of the total words used, more or less. It is quite possible that the difficulty of a text investigated by the Vogel-Washburne technique may vary greatly according to the sample used.

To determine the possibility of variance in grade placement dependent on the sample taken from the text, a history text published late in

[1]Cramer, John F. "Relative Difficulty of Junior High School Social Studies Texts," *Journal of Educational Research*, XXVI (February, 1933), pp. 425-428.

[2]Vogel, Mabel, and Washburne, Carleton. "An Objective Method of Determining Grade Placement of Children's Reading Material," *Elementary School Journal*, XXVIII (January, 1928), pp. 373-381.

1932 and advertised by its publishers for the middle grades, was studied. The preface states how the book has been prepared to come within the comprehension of the children of these grades.

Three samples from this one book were made. To distribute the lines equally throughout the book, the directions given by Vogel and Washburne were followed carefully.

Sample I was the third full line on each page chosen.

Sample II was the fifth full line on the page following each page taken for Sample I.

Sample III was the fifth full line on the same pages used for Sample I.

The same sampling of seventy-five sentences to determine the number of simple sentences was used with the three different 1,000-word samplings.

As stated before X_1 is the reading score necessary for ready understanding of the text examined. This is the score that a pupil should attain on the paragraph meaning section of the Stanford Achievement Test, in order to use the text understandingly and profitably. Table I taken from Vogel and Washburne shows the reading scores translated into reading grades.

TABLE I

GRADE STANDARDS PARAGRAPH MEANING SECTION OF THE STANFORD ACHIEVEMENT TEST
(From Vogel and Washburne)

Scores	Grade
4- 16	II
18- 34	III
36- 52	IV
54- 62	V
64- 70	VI
72- 78	VII
80- 86	VIII
88- 94	IX
96-102	X
104-112	XI

The results obtained from the word count are shown in Table II.

TABLE II

DATA FOR THE REGRESSION EQUATIONS

	Sample I	Sample II	Sample III
Number of different words in 1,000	464	469	465
Number of prepositions in 1,000	145	164	145
Number of uncommon words in 1,000	13	24	21
Number of simple sentences in 75	27	27	27

Substitution of the data for Sample I in the regression equation gives:

$X_1 = 464\ (.085) + 145\ (.101) + 13\ (.604) - 27\ (.411) + 17.43$

$X_1 = 68.27$

The regression equation for Sample II reads:

$X_1 = 469\ (.085) + 164\ (.101) + 24\ (.604) - 27\ (.411) + 17.43$

$X_1 = 77.26$

For Sample III we have:

$X_1 = 465\ (.085) + 145\ (.101) + 21\ (.604) - 27\ (.411) + 17.43$

$X_1 = 73.19$

Table III gives the reading scores obtained for each sample and the reading grade for each score.

TABLE III

READING SCORES AND READING GRADES FOR THREE SAMPLES FROM ONE BOOK

	Score	Grade
Sample I	68.27	VIA
Sample II	77.26	VIIA
Sample III	73.19	VIB

Though Sample II followed all the dicta of the Vogel-Washburne technique the same as Sample I, it shows the text to be one reading grade more difficult than Sample I shows. While Sample III is taken just two lines lower on the same pages as Sample I it is one-half reading grade more difficult than Sample I. Variability as much as this is probably to be expected.

It will be noted that the same seventy-five sentence sampling to determine the number of simple sentences has been used with all of the three 1,000-word samplings. It is just as possible to get variance here by choosing another sample as it is in the 1,000-word groups. Another sampling of seventy-five sentences was made, and this time but 20 simple sentences were found instead of 27. Vogel-Washburne's directions tell how to distribute the selection of these sentences but do not say whether one is to begin the sampling on page 1, or 2, or 3.

Suppose that Sample III had been the only sampling made of this text, and suppose that by chance the second sampling of the seventy-five sentences had been made instead of the first. Substituting 20 (.411) in place of 27 (.411) in the regression equation of Sample III, X_1 would have been 76.06 instead of 73.19. This would have made the reading grade VIIA and not VIB. Different combinations will result if 20 (.411) be substituted in the other equations.

CONCLUSIONS

1. By application of the Vogel-Washburne technique to history material for the middle grades, the reading grade found depends on the samples chosen.

2. If two history books vary but one reading grade as determined by the Vogel-Washburne technique, one cannot be said to be more difficult than the other.

3. The difference in difficulty between the Rugg social studies texts and the histories and geographies they displace probably needs to be determined on some other basis than Vogel-Washburne's regression equation.

4. Though this study shows the unreliability of the Vogel-Washburne technique as applied to history material, one must admit that it is some achievement to get even such reliability as it does. It is possible that a regression equation worked out for a larger sampling might bring greater reliability.

5. Above all, there is the question of the validity of any or all of the samples chosen in this study, or any other study, when the computation of a regression equation gives a figure to be compared with the score on a standard reading test. There is no valid evidence that reading test scores correlate very highly with the ability to read social science textbooks. The evidence tends to be in the other direction.

6. If reading difficulty is to be defined as more than recognition of words, and rather, difficulty in getting adequate meanings, it is apparent that the reading difficulty of a history textbook must be determined in some other way—a way predicated on other bases than those of Vogel and Washburne. Little experimental work has been made available in our literature on the variety of elements and combinations of those elements that make sentences difficult for children at various stages of reading maturity.

A SURVEY OF RESEARCH IN THE TEACHING OF SECONDARY ALGEBRA

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IN the interest of better teaching a vast number of research and pseudo-research problems have been investigated. It is quite essential that there be a pause from time to time and an attempt made to summarize, systematize, and analyze this material for the purpose of effecting a closer coördination and integration of the suggestions and recommendations formulated and proposed. Such proposals may then become the basis of future experimentation and investigation as well as foundation for improved teaching.

This study is an attempt to accomplish such a purpose relative to the research on problems arising in the teaching of algebra in the secondary school. A careful survey of available literature revealed three hundred and seventeen separate studies which could be rather definitely classified under forty-three distinct research problems which, in turn, could be grouped under eight major topics of vital interest to the teacher of algebra.[1] Further possible subdivisions were noted but not deemed advisable for fear that significance of coördination might be lost in minuteness of detail. The forty-three problems follow in their proper classification:

I. Curriculum Content
   (1) Aims and objectives
   (2) Organization
   (3) Comparison of curricula
   (4) Minimum essentials

II. Correlation of Subject Matter
   (1) Mathematical subjects
   (2) Mathematical and other subjects

III. Use of Tests
   (1) Pupil difficulties
   (2) Prognosis
   (3) Classification of pupils

[1] This survey, which does not consider material published prior to 1905, was conducted as a class project; those coöperating were Bernice Burnett, Viola Perry, May S. Strickland, L. S. Kaser, and R. D. Powell.

(4) Measurement of achievement
(5) Survey of information
(6) Relation of mathematical ability to intelligence
(7) Retention of learning
(8) Comparison of mathematical abilities

IV. Teaching Techniques
(1) Analysis of materials
(2) Motivation
(3) Analysis of difficulties
(4) Individual instruction
(5) Class marks
(6) Economy of time
(7) Fundamental skills
(8) Remedial teaching
(9) Supervised study
(10) Special devices
(11) Comparison of methods

V. Historical and Educational Values
(1) Historical
(2) Cultural
(3) Utilitarian
(4) Transfer of training
(5) Desirable abilities

VI. Administrative Practice
(1) Class size
(2) Acceleration
(3) Retardation

VII. Teacher Preparation

VIII. Special Topics
(1) Involution, evolution, and logarithms
(2) Directed numbers
(3) Graphs
(4) Function concept
(5) Verbal problems
(6) Equations and formulae
(7) Factoring and synthetic division
(8) Cancellation and fractions
(9) Irrational and complex numbers

In considering the techniques of investigation those used by Brownell in a similar study[2] were accepted with a slight revision that was found desirable in Group A. This classification of techniques follows:

A. Techniques Requiring Immediate Contacts with Individual Subjects

I. *Controlled Case Study*, or *Laboratory Techniques* in which complete control of the experimental situation is maintained throughout the duration of the study.

II. *Uncontrolled Case Study* or the personal interview.

B. Techniques Adapted to Contacts with Groups as well as Subjects.

III. *The Observation Technique.* Data secured by mere observation of significant behavior.

IV. *The Consensus Technique.* Subjects are merely requested to express their opinions relative to the problem under investigation.

V. *The Testing Technique.* The investigator merely measures the status of a situation as he finds it.

VI. *The Specific Training Technique.* The investigator organizes a special training program to supplement the testing program.

VII. *Controlled-Group Experimentation.* Here paired groups are used with controls to effect a measure of contrasted training programs.

C. Techniques Based on the Results of Subject Work.

VIII. *Correlation and Refined Statistical Technique.* Conclusions of the study are based on an elaborate statistical treatment of the data.

IX. *Analysis of Pupils' Written Work.*

D. Techniques Based on a Study of the Material to be Learned.

X. *Logical Analysis* of the material to be learned for the purpose of effecting a better selection and organization of subject matter.

XI. *Analysis of Texts, Tests, and Other Instructional Material* for the purpose of determining how efficient they may be as

[2] Brownell, W. A. "The Techniques of Research Employed in Arithmetic," Twenty-Ninth Yearbook of the National Society for the Study of Education (1930), pp. 415-441.

instruments to be used in attaining certain desirable instructional goals.

E. Techniques Based on Contacts other than those with Subjects Engaged in Algebraic Work.

XII. *The School Pupil Survey* (IV. *The Consensus Technique* might also be listed here, not as a different technique, however, but the same technique with different subjects.)

F. Techniques Based on Administrative Material

XIII. *Analysis of Courses of Study and School Programs.*

XIV. *Analysis of School Records and Marks.*

G. Techniques Resisting Classification.

XV. *The Comparative Technique.*

XVI. *The Analysis of Non-Instructional Material.*

XVII. *The Historical and Anthropological Technique.*

In the systematic summarization and organization of research two rather natural questions of importance and interest are (1) What techniques have been used in the investigation of the different research problems? and (2) Are there other suitable techniques that might be used in the study of each of these several problems? The accompanying table, in which the problems and techniques are listed in accordance with the above indexes, supplies the quantitative information for answers to these questions relative to research in the teaching of algebra. In this cross classification of "Research Problems" and "Research Techniques" it was frequently the case that one report incorporated more than one problem and that an investigator used more than one technique in the study of his particular problem. A careful study of the table will reveal that certain techniques as well as certain problems have been very popular while others have had very little attention paid them. It is, of course, quite evident that in such a classification, as here presented, blank spaces will occur due to the incompatibility of certain problems and techniques. It is just as true, however, that many of the spaces of zero, as well as those of low frequency value, are highly significant in that they represent existent hiatuses in the research on problems in the teaching of secondary algebra. From the table we find, for example, that in studying the problem of minimum essentials in secondary algebra (I-4) one investigator used the obser-

vation technique (III), nine the consensus technique (IV), one applied refined statistical procedure (VIII), four made the approach through

TECHNIQUES USED IN THE INVESTIGATION OF PROBLEMS IN THE TEACHING OF SECONDARY ALGEBRA

PROBLEMS	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII
I	1			6	1	1				2	2		3		1	2	
	2			23	4	8	2	3		1	12		5		4	1	2
	3		1		1		1	1			2		3	1	11		2
	4		1	9				1			4				3		1
II	1	1		8	4	3	2	2		1	5		3	3	6	2	1
	2		1	1		1	2			3	5		3			1	
III	1	3		1	10	4	2	1	1	2	3		1	4	1		1
	2			1	2			4		1							
	3	1		6	7	2		1	1		3				1		1
	4	1	2	3	7	1	4	3	3		2		1	4	5		2
	5	1		5	9	3	1	6		1	4		1	2	4	2	1
	6	1			4			3		1	2		1	3	2		
	7				3			1	1								
	8			1	2			5		1	2			3	3		
IV	1			1	2	1		1	1	1	7						2
	2	1		5	1	3				5	3		1		5	2	2
	3		2	4	1	1		1	1		4		2		2		
	4	3	1	3	4	2	5			1					2		
	5			1	2	2					2		1	1	1		
	6			1						1	1				1		
	7			2	1	1	1		1	3	3		1				1
	8	4		3	7	6	2	1	1		5		1	1	3		
	9				1		4		1								
	10	6	4	11	6	8	4	1	1	5	6		2	1	7	2	
	11	1	2	3	3	1	6	2	1	1	3		2		2	1	
V	1								1		1		2		1		11
	2			5						1	1	2	1	1	3		2
	3	1		10		1				3	6	3	3	1	1		1
	4			3				1		1	1		2		1		2
	5			1				1							1		1
VI	1	1		1	1		1							1			
	2							1									
	3					1											
VII	1			2									1		3		2
VIII	1		1	3	2	2				1	2		1		3		
	2			3		3		1		3	3				1		
	3	1		3	1	1			1	3	4		1		2		2
	4			2	3			1		3	3				2		1
	5	2	1	6	3	5	2	3		5	6		1				3
	6			1	1	3		1		4	1				1		2
	7									3	1				4		
	8			1		1				1					1		
	9									1							

an analysis of instructional materials (XI), three sought to derive helpful information from a comparison of values (XV), while one felt that it would be profitable to attack the problem from an historical point of view (XVII). Is it not quite likely that results highly significant in the consideration of this problem of minimum essentials might be obtained from the application of the case study techniques (I and II), the techniques of testing (V), controlled-group experimentation (VII), analysis of pupils' written work (IX), and logical analysis of material to be learned (X)? It is, however, rather doubtful that the problem could be so stated or interpreted that the school pupil survey (XII) or the analysis of school records and marks (XIV) would be applicable as investigational techniques. The above example serves as an illustration of an effective method of arriving at the proper interpretation and correct appraisal of the accompanying inventorial analysis of educational research.

No attempt to integrate existing research systematically would be complete without the effort to summarize and organize the resultant conclusions and recommendations. It is of particular interest to note those which are contradictory to each other:

1. Intelligence is a significant factor in achievement in algebra.	1. Tests and grades show that ability in mathematics is not as closely related to general intellectual capacity as we are likely to suppose.
2. There is a significant relationship between ability in arithmetic and ability in algebra.	2. Progress in beginning algebra is not dependent upon a good background in arithmetic.
3. The adjusting of algebraic instruction to ability levels of pupils develops more individual initiative, creates better attitudes, and reduces the number of failures.	3. The results do not favor ability grouping.
4. The Orleans prognostic test is effective for prognosis.	4. The Orleans prognostic test is not a satisfactory basis upon which to make a prognosis of abilities in algebra.

5. Group instruction in algebra produces better results than individual instruction.

5. The individualized unit method produced better achievement and retention in algebra than the traditional group method of instruction.

6. No superiority shown in a comparison between the relative effectiveness of individual study and group recitation.

It is obvious that such contradictory statements call for further experiment that the elements of contradiction may be eliminated and reliable results determined. To present in the most effective manner a conspectus of the non-contradictory conclusions and suggestions it is desirable that they be contemplated in the light of criteria for the discrimination and evaluation of investigational procedures and their resultant recommendations. The three hundred and seventeen research activities of this survey fall into both the quantitative and qualitative categories. Acceptable criteria for evaluating quantitative research are:

1. The use of reliable and valid means of measuring achievement.
2. The careful equation of experimental and control groups.
3. The presentation and interpretation of results in terms of measures of variability as well as those of central tendency.
4. The determination of the statistical reliability of existent differences.
5. The control of or making adequate allowance for the influence of extra-experimental factors.
6. The use of a "fair sample" as a basis for the experiment.
7. The employment of an adequate experimental period.[3]

In the evaluation of qualitative research the following may serve as effective criteria:

1. The experience and reputation of the writer.
2. The intuitive insight of the writer.
3. The soundness of hypotheses.
4. The texture of reflective thinking.

[3]Douglass, H. R., Mueller, Margaret, and Mything, Ida. "Special Methods on High School Level," *Review of Educational Research*, II (1932), p. 7.

5. The familiarity with existent research.
6. The use of authoritative techniques in the pursuance of philosophical and historical research.

The conclusions reached through historical inference, philosophical deduction, and experimental investigation and presented as pertinent to the teaching of secondary algebra are not to be considered of equal weight and reliability. When subjected to the crucible of acceptable criteria they may be differentiated into two quite distinct groups, namely: (1) those that do not measure up to the standards set by the criteria, and (2) those that seem to be significantly valid and reliable. In the subsequent listing the first group will be referred to as *Suggestions*, the implication being that they can be accepted only in the nature of preliminary reports calling for further investigation and study; the second group will be labeled as *Conclusions*, indicating that the stated criteria seem to justify their acceptance as authoritative. In this summary of results the grouping will be according to the eight major divisions followed in the above digest of problems except in the miscellaneous group (VIII) where it will be desirable to follow the order of the subdivisions as well.

A. Suggestions

I. Curriculum content.

1. There is a great need for the reorganization of the program in secondary mathematics from the standpoint of content and the time element. Some suggested plans for such reorganization are:
   a. General mathematics.
   b. Parallel instruction in algebra and geometry.
   c. More emphasis on the psychological rather than the logical arrangement of subject matter.
   d. Greater use of the function concept for correlation purposes; also more emphasis on the equation, formula, and graph.

II. Correlation of Subject Matter.

1. The correlation of algebraic subject matter with that of physics and chemistry is beneficial.
2. The mathematics needed to solve the problems of high school physics is usually taught in arithmetic, algebra, and geometry.

3. There is a high correlation between grades in algebra and those in history and foreign languages.
4. There is a low correlation between achievement in algebra and achievement in high school biology.

III. Use of Tests.

1. The following uses of tests are recommended:
   a. For review purposes.
   b. To point out deficiencies and individual differences.
   c. For diagnostic and remedial measures.
   d. For motivation of work (hurdle tests).
2. One year of high school algebra is not sufficient as a prerequisite for college algebra.
3. Pupils seem to retain algebraic subject matter approximately in the ratio of 1:3. Retention is best in factoring; substitutions; solution of problems, both numerical and verbal; calculation of averages; and construction of graphs. It is poorest in the handling of fractions; exponents; solving quadratic equations and systems of simultaneous equations.
4. There seem to be no significant sex differences in algebraic ability.
5. Comprehension of algebraic terms is very low even at the twelfth grade level.

IV. Teaching Technique.

1. There are nine major difficulties that students have in the study of algebra.
   a. How to grasp new algebraic concepts.
   b. How to master difficult or complex processes.
   c. How to set up equations for the solution of problems.
   d. How to improve speed and accuracy in the fundamental operations.
   e. How to check work.
   f. How to use short cuts.
   g. How to profit from class work.
   h. How to make daily preparation as effective as possible.
   i. How to review and take tests.

2. The time of day seems to have no material effect upon the results of instruction in algebra.
3. Suggested remedial measures: drill exercises and cards; flash cards; workbooks; listing of principles; use of charts to show individual differences and to motivate work; division of class period into three parts: (a) diagnosis, (b) drill, (c) preparation.
4. Recommended methods of motivation: history of algebra; use of parable that is—, reveal the abstract principles by leading pupils from familiar experiences to generalizations; practical applications; algebraic recreations and puzzle problems; projects; and graphs.
5. Teaching techniques recommended as effective: laboratory method, socialized recitation, outline method of presentation of subject matter with maximum amount of oral work, heuristic method.

V. *Historical and Educational Values of Algebra.*
1. The teaching of algebra in the secondary schools can be justified from utilitarian, cultural, and esthetic points of view.
2. The ability to recognize mathematical concepts in high school physics, which is primarily a mathematical ability, seems to be an important factor in the comprehension of physics' materials.
3. All of the mathematical problems for the practical field of dairy technology can be solved by arithmetic or algebra.

VI. *Administrative Practice.*
1. Acceleration in ninth grade algebra seems to penalize students in algebraic ability.

VII. *Teacher Preparation.*
1. The minimum training for the teacher of high school mathematics should include college algebra, plane trigonometry, plane analytic geometry, differential and integral calculus, theory of equations, history and pedagogy of mathematics, applied mathematics (physics), and modern languages.

VIII. *Special Topics.*
1. *Directed numbers.* The use of the thermometer, concepts of B. C. and A. D., longitude and latitude are recommended for introducing directed numbers.

2. *Graphs.*
   a. Careful distinction should be made between functional and statistical graphs.
   b. More general use of the graph in dealing with formulae and equations is recommended.
3. *Verbal problems.*
   a. The analytic method is generally conceded by teachers to be the most effective method of attack on verbal problems.
   b. Considerable practice in problem analysis is an aid to the pupil in solving verbal problems.
4. *Equations and formulae.*
   a. Careful distinction should be made between identical and conditional equations.
   b. The early use of simultaneous linear equations is recommended.

B. Conclusions

I. *Curriculum Content*

1. The teaching of secondary mathematics in the United States does not compare favorably with that in other countries.
2. Various lists of objectives formulated by committees conform very closely to that proposed by the National Committee on Mathematical Requirements in their Report on the Reorganization of Mathematics in Secondary Education.
3. In addition to acquiring accuracy and speed in the fundamental operations with algebraic expressions, the student should understand directed numbers, should be able to manipulate formulae and equations, should learn the technique of making generalizations and acquire the habit of accuracy in mathematical thinking. The associative skills should be emphasized along with the manipulative skills.
4. The core vocabulary of algebra consists of fifty-two words.

II. *Correlation of Subject Matter*

1. The introduction of numerical trigonometry is valuable as an aid to instruction in elementary algebra.
2. The correlation of algebra and geometry facilitates psychological arrangement of subject matter, reduces formalism, and furnishes motives for further study.

III. *Use of Tests.*

1. Tests should be reliable, valid, and objective.
2. Diagnostic testing followed by a program of remedial instruction is of definite value.

IV. *Teaching Techniques.*

1. Sources of error in algebra are: deficiencies in the fundamental skills and concepts of algebra and arithmetic, carelessness, fatigue, confusion of such contrasting concepts as coefficients and exponents, too much explanation and not enough testing on part of teacher, removal of signs of aggregation, factoring, completing the square, removal of radicals, construction and solution of equations, use and interpretation of formulae, substitution, common and decimal fractions, directed numbers.
2. Supervised study is effective as a means of instruction.
3. Types of memory involved in the learning of algebra: sheer recall, reflective recall, habitual recall, algorismic recall, conceptual recall, mnemonic recall.
4. The teacher should make an effort to preserve uniformity in algebraic symbolism and to impart definite significance to it.
5. The process of learning must be infused with interest.
6. A definite means of transition of knowledge must be provided.
7. The use of rapid oral drill and keyed exercises is very helpful.
8. There exists a statistically reliable advantage in favor of individual instruction on a modified Winnetka plan as compared to group instruction on a modified Morrison mastery plan.
9. Provisions for habit formation are neglected.
10. Students enter secondary algebra with inadequate preparation.

V. *Historical and Educational Values of Algebra.*

1. Algebraic training should develop the following abilities: to understand and frame formulae and equations, to solve problems, to construct and interpret graphs, to analyze, generalize, symbolize, think relatively, and organize.

2. A survey of competent laymen revealed a desire that algebra be retained in the secondary program.
3. From a vocational point of view the six most useful algebraic concepts are: liberal numbers; linear equations and formulae; directed numbers; algebraic addition; the statistical graph; ratio, proportion, and variation.
4. There should be a closer connection between mathematics and its applications with a more general use of concrete examples and the emphasis of checks.
5. Historically arithmetic, algebra, and geometry experienced a parallel development.
6. The concepts of the line and the square are fundamental to intelligent comprehension of generalized number and form.

VI. *Teacher Preparation.*

Graduation from a standard four year course including work in plane and spherical trigonometry, plane analytic geometry and the elements of analytic geometry of three dimensions, college algebra, differential and integral calculus with applications to geometry and mechanics, synthetic projective geometry, scientific training in algebra and geometry, theoretical and practical physics, chemistry, four semesters of psychology and education, satisfactory performance of the duties of a teacher of mathematics in a secondary school for a period of not less than 20 semester hours.

VII. *Special Topics.*

1. *Graphs*
   a. The most extensive need for algebraic knowledge (outside the field of mathematics) is the ability to use graphs.
   b. Inability to deal with the four fundamental operations is a major source of error in the construction and interpretation of graphs.
2. *The Function concept.*
   a. The use of the function concept does not receive the emphasis it should.
   b. Understanding of the fundamental characteristics of functional thinking is acquired early.

c. Ability to recognize equations, to understand relationships in line graphs, and the meaning of linear and quadratic functions is not acquired before the end of the junior high school.

3. *Verbal problems.*
   a. In handling verbal problems pupils have the greatest difficulty with comprehension of the problem, determining what is given, and the translation of the statement of the problem into algebraic symbolism.
   b. Verbal problems should be meaningful; they should contain superfluous and insufficient data as well as just enough data.
   c. There is practically no correlation between interest in verbal problems as expressed by pupils and importance or interest as estimated by teachers. Teachers rate as most important those problems that deal with economic situations while pupils are most interested in those that express activity, and in particular child-activity.
4. *Equations and formulae.*
   a. A great source of error in the treatment of equations and formulae is the handling of signs.
   b. There exists a high correlation between speed and accuracy when dealing with equations and formulae.

MICROBIOPHOBIA AND BOOKS

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"A lamentable thing it is to consider how many myriads of books have fallen beneath the wheels of superstition . . . The bravest spirits of all times have suffered from the intolerance of zealots. . . . He that shall read . . . of the destruction of great libraries, rare manuscripts, noble tomes innumerable, so curiously made with such infinite cost and labor, may stand amazed and never wonder enough at it; and thank God withal, that by the light of science and the spread of tolerance we are so happily freed from that slavish fanaticism in these our days, for heretofore, almost in all countries, superstition has blinded the hearts of men and led them to bibliophobia and from thence to acts of biblioclastic frightfulness." So writes Holbrook Jackson in his book of intriguing title *The Fear of Books*. A certain class of people always has and always will fear books. That is to say, they fear the contents of books. There are other fears or phobias, some abnormal, some relatively common. There is phthisiophobia or the insane and everlasting fear of tuberculosis. There is the more general and more common fear, microphobia or micro-biophobia, the fear of germs. One has only to go through an epidemic or read of one to realize the panic that strikes man's mind causing him to believe anything he hears and reads. Accordingly, just as men are accused, so have books been called to judgment, tried and often condemned as carriers of infection.

What is the history of this fear of books? When were books first suspected as vehicles of pestilence? No doubt careful research would reveal reference to books as carriers of disease running as far back perhaps as the Great Plague of London. A writer in the *Saturday Review of Literature* (24) has some such thought in mind when he says, "There must be somewhere an allusion to the fears of books during the Great Plague of London, but Samuel Pepys seems nowhere to refer to this emotion. Under September 20, 1665, Pepys notes that the roster of the stricken has reached 7,165 and writes 'what a sad time it is to see no boats upon the river; and grass grows all up and down White Hall Court, and nobody but poor wretches in the streets.'" Yet, on October 5, he accepts from John Evelyn a copy of a book on 'Instructions Concerning the Erecting of a Library.' And within a week of his noting another increase in the number of sufferers he says, "We walked as low as Ducke Lane and inquired for some Spanish books." Apparently it had not

occurred to this cautious but observant man that books were dangerous, at least on the outside.

It is perhaps true that it was not until after the public library movement became established and books began to circulate among 'hoi polloi' that general suspicion was directed against them. The Encyclopaedia Britannica (Vol. 14, p. 23) states that the modern public library maintained by the municipality or some other unit of local government from the proceeds of taxation was scarcely known before 1850. It has developed for the most part since the formation of the American Library Association in 1876. The question of library books and contagion was brought up on the floor of the second annual conference of the American Library Association meeting in 1877. At that time the question was discussed pro and con in much the same manner as it has been discussed ever since.

It is interesting to note that a review of some thirty articles covering a period of more than sixty years reveals practically no evidence of contagion carried by books. While physicians have always maintained that theoretically such contagion was possible, they have never been able in the majority of cases to give direct evidence to such effect. W. F. Poole, Librarian of the Chicago Public Library, speaking before the American Library Association in 1879 on the subject of The Spread of Contagious Disease by Circulating Libraries (22) stated that due to newspaper agitation the board of directors had written to the nation's medical and sanitation experts as well as to the managers of the largest libraries. Not one of them could give any fact observed by him tending to show that contagion was ever given by a library book. Dr. Green, City Physician of the city of Boston during the small-pox epidemic of 1872, had written that he had tried to trace the history of each of the 4,300 cases. In no case was he able to connect infection with library books. In 1882 the Chicago Public Library reported: "It is a fact worthy of notice that during the recent severe scourge from contagious diseases, which taxed to the utmost the resources of the health department, no case of transmission of the disease was traced to a library book and no suspicion was raised that it had occurred." (12)

In 1883 the *Library Journal* (13) quoting from the *Nation* apropos of an article in the medical journal *The Lancet*, stated: "As to this newly discovered danger, it will be advisable for cautious persons to read no book which is not accompanied by a medical certificate that it has never been read by any person having or having had an infectious or

contagious disease. A surer way still will be to imitate the practice of clubs in regard to fresh packs of cards and never read a book after it has been read by anyone else. In the meantime, it may be a comfort to timorous persons to know that in great public libraries whose books circulate without restriction, when the small-pox has been raging, it has never been communicated to the attendants by books, nor, so far as is known, to any of the other borrowers.'' In the Third Biennial Report of the State Board of Health of Iowa for 1885, Mr. H. H. Clark (14) reported, as the results of an inquiry made among 400 physicians as to the occurrence of the communication of contagious disease by second-hand school books, that no case of such conveyance had been found, the nearest thing to it being a report by a Dr. Christian of Wyandotte, Michigan, of a case of scarlet fever communicated from one person to another through the medium of a novel.

In the meantime, similar discussions were going on in England perhaps with a little more color and considerably more vigor, for we find the editor of the *Library* stating in 1889 (7): ''We have been taken to task for ignoring the library-infection scare. Surely, it is obvious that the silly people who raised it were acting very much on the principle that 'any stick will do to beat a dog with.' They hate the free library and all its works, and anything is good enough for a cry against it. If we were to answer them seriously, we would remind thinking people that the Free Library and its books are the last sources from which infection is spread. . . . Who is to prevent careless wretches, freighted with infection, from entering the theatre, the church, the railway carriage and omnibus—to say nothing of the pestilence that, walking in darkness and from the sweater's den, brings havoc and death equally to the lord and pauper. But seriously, we feel that to notice such puerilities is to answer a fool according to his folly.'' It would seem that this early fear of books was not wholly disinterested. But our editor is not through, for in 1895 (8) we find him writing, ''It is extraordinary how hard to kill is the vague theory that infectious disease are freely spread by infected books but still stranger that a paper making any pretence to scientific accuracy should commit itself to such an emphatic opinion as that which recently appeared in Science Siftings. Says the Editor, 'We believe the bulk of disease among the educated classes is spread in this way!' We might retort that if the editor believes that 'he'd believe anything.' '' The writer then goes on to report an investigation among

medical officers who had found no cases of the spread of disease through books.

This tale was not finished, however, for the editor of Science Siftings replied as follows: "Our learned little contemporary, *The Library*, has written some paragraphs on 'bogus-anti-library panics' anent the strictures we have published as to the danger of spreading disease by means of books. . . . Were our contemporary expressing an opinion as to literary culture, or the ethics of log-rolling, we should certainly bow to his decision. . . . *The Library* has, doubtless, its own reason for arguing as it does." The editor of *The Library* then gave in reply a summary of an experiment in the spread of contagious diseases through books which will be discussed later.

In 1891 the *Library Journal* (15) gave an account of a collection of expert opinions as to books as carriers. A Dr. Baker, Secretary of the Board of Health of Michigan, gave an account of a patient who had contracted scarlet fever in this manner, while a Dr. Plunkett, President of the Board of Health of Tennessee, had heard of a case of small-pox contracted in a similar manner. The librarians consulted knew of no cases of disease transmitted by books. Another prominent medical man, while saying he thought that practically no mischief was likely to result, nevertheless advised the disinfection of books in order to give popular confidence and to allay apprehension.

In 1900, we find J. J. W. MacAlister, Librarian of the Royal Medical and Chirurgical Society, and W. J. Savage, M.D., Bacteriologist to the Cardiff and County Public Health Laboratory, reporting to the British Library Association as follows (10): "From time to time the public have been scared by the suggestion that during epidemics there is a grave source of danger in public libraries, the books from which might pass from the hands of persons suffering from infectious diseases. The question had been dealt with statistically and otherwise both by librarians and medical men, with the result that the authorities generally believe that if reasonable precautions are taken by notification and withdrawal of infected books there is practically no danger. Nevertheless, alarmists and sensational newspapers are able every now and then to frighten the public and have even succeeded in getting public libraries closed during epidemics. The authors think they have proved there is no ground for alarms, or for any drastic measures."

In January, 1902, the *Library Association Record* (11) stated: "Notwithstanding the opinion expressed last year by a member of the Library

Association that the danger of infection from books was infinitesimal, the Chicago Public Library again investigated. Experts at this time found a large number of bacilli representing nearly 100 different poisons and disease germs in fifty books selected at random. . . . Bacteriological investigations, like statistics, seem able to prove anything." On the other hand, the same library, because of public excitement in 1906 caused by an epidemic, had the Board of Health investigate some of the most used library books. No disease-producing bacteria were found.

In 1905 the Baltimore Public Library reported (20) that while it had been in existence about nineteen years, and during that time had had in its employ about 175 clerks of all ages, among these clerks there had not been a case of any contagious disease. At the same time the Cleveland Public Library reported (20): "For the past eighteen years there has not been a case of contagious disease of any kind in any of the public departments of the main library or its branches. As there are now more than 75 persons employed in these departments and as each book is handled by not less than three people between the time of its return and re-issue, it seems probable that if contagion were readily carried by the books, the library employees would be affected." The editor of *Public Libraries*, in which the above report appeared commented thus, "This seems to be a perennial question and unlike most questions in the library field does not yield to the overwhelming evidence against it."

However, the discussion of micro-phobia and books was not confined to England and the United States for in 1909 J. Bayer, a Frenchman, wrote an article on the "Disinfection of School Books" for the *Scientific American* of July 24, 1909, in which he claimed knowledge of a French woman and her daughter contracting scarlet fever by means of a letter, whereof the mother died. He also had report of a case of similar contagion in Russia and another from Lansing, Michigan, which stated that twenty employees of the Health Department had contracted tuberculosis from an account book. It is interesting to observe the geographical distribution of his evidence and to note further the lack of any substantiation of his Lansing data.

In 1922, Dr. Richard Cabob, Chief of the General Staff of the Massachusetts General Hospital, was quoted as saying, "All the best authorities on public health and contagious diseases are in agreement that the precautions we once used to carry out in the disinfection of books, clothing, etc., after their contact with persons suffering from contagious dis-

cases are quite unnecessary. . . . The first health board which stopped disinfecting did a great public service which other health boards can follow." Finally, we find in the *American City* for January, 1929, a reprint from the *Lancet* for November 17, 1928, containing a report of a committee of the British Board of Education. This committee, comprising representatives of the pathological laboratories of the Ministry of Health, several county and urban medical officers, etc., advised that books cannot be considered as dangerous sources of infectious diseases. The report of the committee stated that there are so many more real and important factors in the spread of diseases that the role of books in their conveyance is almost insignificant.

This then is the direct evidence concerning books as carriers of disease over a period of sixty years. It is quite possible that such conveyance has occurred but apparently no librarian has known of such a case or at least has seen fit to publish it. On the other hand, a very few doctors have reported a few possible scattered cases, not very well established. What evidence there is seems to indicate that in Michigan, books are far more dangerous than elsewhere or else that the people of Michigan are more susceptible to book-born germs. In so far as the direct evidence is concerned, one may almost conclude with the editor of the *Library World* (19) that "it almost appears as if it were impossible to carry infection by means of books. . . . The merry microbe is not literary. It would be interesting to ascertain why books seem to be immune to the visitation of the microbe; is it printers ink he doesn't like? Or, is it that he is literary, and, as a consequence, avoids the greater press put-out." The quotation is thirty-four years old so perhaps the facetious reasoning no longer holds.

So much for the direct evidence as to the power of books to carry infection. What indirect evidence is there that it is theoretically possible for them to do so? Research reveals several studies. The first experiment located was conducted in 1892 when the editor of *The Library* (8) mentioned before, procured condemned volumes "sticky with filth" from the Manchester (England) Library. These were distributed among diphtheria, scarlet fever and small-pox patients. The experiment could hardly have been pleasant for the patients, at least, but according to the author, the books were handled by the patients for a period of a month and were then given to a number of monkeys to play with. These animals accordingly tore the books apart, chewed the pages and in general were quite intimate with the possibly infected vol-

umes. Finally, the author soaked some of the pages in milk and fed the milk to the monkeys. The effects were nil according to the reports given.

De Cozel and Catrin (18) in 1895 and Lion, 1895 (18) found many bacteria in used books. Their results were positive for diphtheria bacillus, streptococcus and pneumococcus, although negative for tubercle bacillus and bacillus of typhoid. Mitulseen (1903) cut pieces from the dirtiest parts of 37 books which had been in the Berlin (Germany) Public Library for from three to six years, soaked them in a normal saline solution, centrifugalized the liquid and innoculated 57 guinea pigs. Fourteen died of septicaemia, while fifteen contracted tuberculosis. MacAlister and Savage (1900) (10) subjected soiled and new library books which had been used for weeks by patients suffering from tuberculosis, diphtheria, and typhoid, to careful bacteriological examination. They reported that with one exception it seemed almost impossible to carry infection by means of books. "It is possible by wetting the thumb and turning over the leaves of an infected book to gather up disease germs, and by a repetition of the wetting to convey them to the mouth." Boyer (1909) (3) claimed that experiments showed that virulent bacilli became inert as follows: cholera vibrie, 48 hours; diphtheria germs, 28 days; bacillus of Ebert (typhoid) 40 days; bacillus of Koch (tuberculosis) 130 days. Kenwood and Dove (1915) (5) reported a study under the title of "The Risks from Tuberculosis Infection Retained in Books." According to them "in the tubercle bacillus we have an organism the virulence of which at any time can be demonstrated by inoculation into lower animals, since it is certain that some strains of organisms under saprophytic circumstances become harmless to humans through much attenuation or loss of virulence. The tubercle bacillus is a facultative anaerobe, capable of surviving in the closed pages of a book as well as upon the cover." Kenwood and Dove performed a series of four experiments as follows:

Experiment 1.

Small sheets of paper were given to patients in the advanced stages of tuberculosis. Patients were asked to hold these close to the face when coughing. After 24 hours the papers were collected, kept under a glass jar for two days, washed off and the liquid injected into guinea pigs. Results: Eight out of fifteen contracted tuberculosis. Note: The authors called this a very severe test.

Experiment 2.

As above, except that the papers were kept under the jar for 31 days. Results: No cases of infection.

Experiment 3.

Examined books returned to the Stoke Newington Public Library, after having been read by notified cases of phthisis with tubercle bacilli in sputa. The dirty spots were washed and guinea pigs again injected. Results: No pigs contracted tuberculosis: Note: the authors note that their results did not bear out a similar study in Berlin.

Experiment 4.

To see what happened when a patient wet his thumb in turning pages. Results: A severe test gave tuberculosis to guinea pigs. Repeated after 30 days when nothing happened.

The conclusions of the authors were that although there probably was no material risk involved in the re-issue of books recently read by consumptives, and although it is rare to find tubercle bacilli in the saliva of the consumptives, the habit of wetting the thumb to facilitate the turning of pages is very likely to convey infection to books, for patient's hands become infected from the handling of handkerchiefs.

Balmain writing in *The Lancet* (November 26, 1927) (2) on the Recovery of Streptococcus Scarlatinae from Experimentally Infected Books reported that this was an investigation attempting to ascertain whether under experimental conditions; (1) the streptococcus scarlatinae would survive on books; and (2) the length of time this organism would live. He stated moreover, "Whether infected books can give rise to fresh attacks of scarlet fever is a question which can only be determined by the actual infection of human volunteers susceptible to the disease." Two methods were used: Two strains of streptococci were isolated from the throats of early cases of scarlet fever. Cultures of these organisms in blood broth were spread on to the pages of books in large and small doses: (1) heavy spraying with a nasal atomizer so that the pages were soaked, (2) light spraying with a scent sprayer. Results: The number of streptococci colonies obtained on blood agar diminished in number after six days and no streptococci could be isolated by the twelfth day from two of the books. With the heavily sprayed books recoverable streptococci were scanty after eighteen days and hardly recoverable after the twenty-sixth day. Streptococci scarlatinae are recoverable during a period of four weeks.

Finally, Dr. Smiley of the staff of Charles V. Chapin Hospital at Providence, R. I. (1832) reported an experiment as follows: Sterile strips of filter paper were saturated with a live broth culture of (1) streptococcus hemolyticus, isolated from a case of scarlet fever and (2) staphylococcus albus, isolated from a boil. These strips were then placed (1) on the outside of a book and (2) between the leaves. The books then were subjected to various treatments of light, moisture and temperature and at various times pieces of the strips investigated. Results and conclusions:

1. Hemolytic streptococci when present on the surface of a book are no longer viable after three weeks exposure to room temperature and at higher temperatures are no longer viable after shorter periods of time. Staphylococcus albus is apparently more hardy.

2. Upon the pages of the book they are no longer viable after four days.

3. A safe general rule appears to be that books, not grossly contaminated, if left untouched in a warm room for a few months are not capable of transmitting infection.

4. Spore-bearing contaminants (anthrox) are not included in this experiment.

Library authorities and health officers have handled the matter of suspicious books with greater or less severity depending on the disposition of the person in charge or the state of public uneasiness. Either the destruction of books or their disinfection by means of formaldehyde seems to have been the favorite method at first.

By 1907, the French at least had grown ultra careful, for the *Chicago Inter-Ocean* published a special cable dispatch from Paris on the attitude of French physicians in regard to the peril of lending books. Drs. Jose Ballia and Nicholas V. Grees drew up a list of measures destined to prevent the contamination of books by septic germs and to avoid numerous risks of contagion: (17)

1. The installation of bowls for hand-washing at the entrance and exit of the reading room.

2. Washing the floor and furniture of the rooms with the antiseptic solution.

3. The use of sterilizing moisteners with the object of avoiding the moistening of reader's fingers with saliva.

4. The distribution of squares of glass to be placed over the pages while they are being read, so as to avoid any soiling by the results of involuntary acts such as sneezing or coughing.

5. Disinfection by formalin or fumes of sulphur for books returned from home reading.

6. Destruction of very cheap works.

7. The publication in schools and other educational centers of instruction regarding the need and the means of avoiding contagion by borrowed books.

One may almost concede that such a procedure was using due care.

In 1922 the practices in treating books exposed to contagious diseases of fifty-six libraries throughout the United States was:

1. Contagious and virulent diseases
   a. Destroyed books—33 libraries
   b. Destroyed books in case of small-pox and fumigated others—4 libraries
   c. Fumigated—11 libraries
2. Minor diseases as measles
   a. Fumigate—33 libraries
   b. Destroy—4 libraries
   c. Do nothing—13 libraries
3. Tuberculosis patients
   a. Fumigate—16 libraries
   b. Destroy—6 libraries
   c. No record—27 libraries

It is hardly necessary to refer to all the many devices described for disinfecting books. Suffice it to say that most of them involved the use of formaldehyde and heat. Two schemes, however, might be described briefly. The first is given in the July 24, 1909 issue of the *Scientific American* under the title of "Disinfection of School Books." The author, Jacques Boyer, describes an elaborate process by which all the school books at Montreuil, France, were to be disinfected annually in a special apparatus containing a "beating chamber" and ovens where the books were hung over a vessel filled with a solution of formaldehyde and the ovens heated to a temperature of 122 degrees F. The author stated that the system was to be extended. How general it became, we do not know. The other means of disinfecting books is described in articles in the *Saturday Review of Literature* for February 25, 1933, and April 15, 1933, entitled "Cooked Books." It seems that according to this method, infected books are placed in an "auto-clave." An auto-clave is "a kind of a high-hat double-boiler about the size of a sugar barrel that roosts on iron pipe legs. . . . At first glance, and at last

as well, it bears a clumsy resemblance to Samuel Pickwick and George Herman Ruth." This auto-clave is then a device "in which streptococci et id genus onne have the living daylights stewed out of them" and books are cooked with "the heat of Milton's Hell."

At present, then, while on the whole less is said concerning books as carriers of contagion, it still is a subject of highly controversial character. Perhaps the rules described by George Lathrope in the *Library Journal* of October 1, 1932, are representative of good modern practice. After writing to various libraries as to practice, to the New Jersey State Board of Health, to the Library and Research Department of the American Medical Association, to the librarian of the New York Academy of Medicine and to the tuberculosis specialists at Saranac Lake, N. Y., and Asheville, N. C., the data secured were submitted to three well known physicians. The men then drew up a set of rules as follows:

Rule 1. The Board of Health shall furnish the library with a list of communicable disease cases, daily, if possible. A card is then sent to the family in question asking them to hold the books, if in contact with the patient, until after the quarantine.

Rule 2. In the case of anthrox and small-pox, the borrower shall be requested to burn the books.

Rule 3. Books in actual contact with a patient during the infectious period of scarlet fever, septic sore throat, diphtheria, cerebrospinal meningitis, poliomyelitis, encephalitis lethargica, typhoid fever and active pulmonary tuberculosis shall be thoroughly dusted with a blower, exposed to sunlight and fresh air for 48 hours and then stored for three months.

Rule 4. Books in contact with measles, German measles, whooping cough, chicken pox, and mumps shall be dusted with a blower, exposed to fresh air and sunlight for 48 hours and returned to circulation.

Rule 5. Books in the home but not in the sick room in rules three and four shall be treated as in rule four.

Note: Other methods of disinfection such as the use of formaldehyde heat, moist or dry, may be discarded.

There is then an association of microbiophobia and books. At least since the establishment of the public library system and probably before that time, there has been an argument pro and con as to whether books can and do carry infection. At no time has investigation disclosed any substantial direct evidence as to such conveyance. However, partly because controlled investigation seems to imply that infection by books is

theoretically possible and more largely because the public refuses to be convinced that the danger of contagion via books is extremely slight, health officers in general advise precautionary efforts on the part of those handling circulating books, whether in the public library or in the school.

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15. *Library Journal*, XVI (March, 1891), p. 80.
16. *Library Journal*, XXII (August, 1897), p. 388.
17. *Library Journal*, XXXII (October, 1907), p. 442.
18. *Library Journal*, XLIX (May, 1924), p. 416.
19. *Library World*, III (1900), p. 146.
20. *Public Libraries*, X (February, 1905), p. 96.
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22. Poole, W. F. "The Spread of Contagious Disease by Circulating Libraries," *The Library Journal*, IV (1879), pp. 258-262.
23. Roseman, M. J. *Preventive Medicine and Hygiene* (D. Appleton & Co., 1931), p. 1388.
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EDITORIAL

AN OUTLOOK FOR EDUCATIONAL RESEARCH

In the *Journal of Educational Research* for January, Professor Raymond H. Wheeler presented a most stimulating article in which he pointed out that human thought has been oscillating for a long time between the atomistic and organismic points of view. The atomistic view has been in the ascendency since 1860 but the swing appears now to be toward the organismic. Educational research had its birth and its entire life in a period of atomistic research. The group of organismic thinkers of which Wheeler is one, now assert that all of the findings of educational research must be discarded as unsound.

If there is any truth in the organismic contention it is obvious that research workers in Education have a job on their hands. Is it possible that we have been suffering from a delusion for the past quarter of a century? If the atomistic view point is passing what place will there be for educational research of the organismic sort? These questions appear to be legitimate enough and some sorts of answers are necessary. Our immediate task as educational research workers is to find the answers.

The problem is too broad and too fundamental to consider here in toto but a few statements concerning it may be in place. Under the atomistic point of view the part or atom is of prime importance. The whole exists only as a sum of the parts. This involves the assumption that the parts can be added and addition, as every elementary school child knows, assumes the existence of a common denominator. We cannot add inches, minutes and ounces. It is possible to add only when the addends are of known value and of the same order. This is a mathematical law that has been verified in human experience again and again.

With these facts in mind we may need to study some of our research productions. Can we, for example, arrive at a sound curriculum by adding together the results of an activity analysis? Can a teacher training program be arrived at in this way? What are the elements that constitute good citizenship? Are they of known value and of the same order? Can we arrive at a desirable theory and practice in see-

ondary education by adding together the practices in all high schools? Can we arrive at a scholarly knowledge of child psychology by summing up all the experiments in that field? The organismist answers no to all these questions. Up to date we have tried to ignore his criticism but in the future we shall have to answer it. We can answer it if we can show that our elements are of known value and single order.

There is another criticism made by the organismist that is even more troublesome. He asserts that wholes arrived at by adding elements do not provide for growth. The time element is ignored. Assuming that wholes can be obtained under prescribed conditions of additivity how shall we point the way toward progress? Shall we assume that present curricula, present ideals of citizenship, present practices in secondary education, in child psychology and what not are desirable for all time to come? We are told that we are living in a changing civilization, that, even if our technique is valid as of today, we yet have no real advice to offer for the future. In short our science is worthless because it does not enable us to predict. This criticism is indeed, serious. According to it for example the recent National report on Secondary Education is already largely a matter of the dead past.

The swing toward the organismic point of view appears to be upon us whether we like it or not. The new movement is almost certain to have an important influence upon educational research. We shall have to develop, however, a technique for critical research by which our present methods may be guarded against fallacies. We shall need also to familiarize ourselves with the methods of research which have been developed in other fields under the organismic view. These techniques can be found in mathematic and the natural sciences. The research methods of other fields cannot be applied blindly and the workers in educational research have known far too little of their research methods.

Two features of organismic research technique seem particularly applicable now to the field of Education. The first has to do with vocabulary. The field of Education has few technical terms of its own. Most of its fundamental concepts are multi-ordinal, that is they have different meanings to different people. Haggerty has recently pointed out the confusion between philosophy and creed. Such terms as coöperation, citizenship, and even education itself are multi-ordinal. Before much progress can be made, we must have a vocabulary of single valued concepts.

The second is concerned with consistency. Educational doctrines must not involve contradictions. No statement is valid if its contradictory is true for a given situation. All educational creeds need testing of this sort. Is it true, for example, that education is the "pillar of cloud by day and of fire by night" that is destined to lead us through the wilderness? Illustrations of truth to the contrary abound. Is it true that "education is not a preparation for life," that "education is life"? Again there is argument to the contrary. Our educational literature teems with statements which need investigation with regard to the truth of the contrary case.

The development of such new techniques will not be easy. Some thinkers will look upon a suggestion of truth to the contrary as blasphemy. Others will resent the necessity of changing their habits of thought. Still others will insist that the new technique is not research at all. The opposition of vested interests in research is not an impossibility. In spite of all this the search for truth must go on. The real test of a research worker lies in his willingness to discard poor methods in favor of better ones. In the end truth will and must prevail.

W. J. Osburn

REVIEWS

Address all communications relative to book reviews to Editor Kai Jensen, University of Wisconsin, Madison, Wisconsin.

BAGLEY, WILLIAM C. *Education and Emergent Man: A Theory of Education with Particular Application to Public Education in the United States* (New York: Thomas Nelson and Sons, 1934), pp. XIV + 238.

"We shall always need philosophy" for "problems demanding immediate answers, or at least answers before adequate investigations can be made will always be with us."[1] There is an implication in this statement—and the context confirms it—that philosophy deals inadequately with problems, which science could settle adequately, provided sufficient scientific progress had been made. Whether this claim for the theoretical final triumph of science is properly grounded or whether science is inherently incapable because of its method of making decisions as to values, it will be agreed by all that Professor W. C. Bagley in his *Education and Emergent Man* is dealing with problems of immediate practical import to everybody engaged in the work of education—problems to which there is an implied solution in almost every moment of the work of school superintendents, principals and teachers.

In this book in which he avowedly presents his philosophy of education Professor Bagley expresses himself as being on the whole somewhat disappointed in the outcome of the scientific study of education. In general the movement toward the establishment of a science of education has been dominated by a false psychology of learning which has been too mechanical. Indeed, all sciences which include man within the range of their phenomena must abandon the purely deterministic hypothesis of the physical sciences, and as a result must admit a certain lack of cogency in their findings.

At no point in American education, for example, is there such a mess as in relation to the subject-matter of instruction, and this largely because of, rather than in spite of, the recent heroic attempts to select curricular material on a scientific basis. Professor Bagley has little use for the results of the work of the curriculum experts under whose direction are prepared courses of study supposedly adapted to the needs of each local community. The overwhelming need of supplying a common cultural background for all the potential citizens of a democracy, and the large amount of shifting of population in this country, make such methods of curriculum construction not merely "silly" but "tragic." "Unfortunately, there has developed in American education a highly emotionalized prejudice against the word 'uniformity.'" Compare the results of American education with those obtained in countries like France, where uniformity of administration and set curricular material are the characteristic methods. America suffers in the comparison in certain definite ways, such as lucidity of oral and written expression, amount of solid reading

[1] Kelley, T. L. *Scientific Method* (Columbus: Ohio State University Press, 1929), p. 137.

material read, prevalence of crime, illegitimacy, alcoholism, and social diseases. "Every outstanding political leader since the establishment of the Third Republic has been a distinguished scholar. These are the results of universal education that can be spread on the balance sheet of social statistics."

Professor Bagley is also outspoken in his criticism of the measurement movement in American education, though he is much more critical of prevailing misinterpretations of the results of measurements than of the measurements themselves. He again reviews the results of intelligence tests and scores the hereditarians. Nevertheless he admits that "probably the severest handicap that confronts universal education . . . is the difficulty of providing materials of instruction and methods that will meet the varied abilities and proclivities of large unselected groups." Homogeneous grouping on the basis of intelligence tests does not do away with heterogeneity, and the results of educational guidance and similar distractions of the school from its main function which is that of instructing youth, are far from being a pronounced success. Tests are more helpful in diagnosing disabilities than in diagnosing abilities. The Minnesota plan may prove successful for higher education, and the Briggs plan for the Junior High School, but the problem remains acute for the first six years of school life. The chief danger of the measurement movement comes from the setting up of average performances as norms, thereby greatly aggravating a tendency already existent, which, in behalf of a sentimentalized doctrine of democracy sacrifices the level of attainment of the competent to what it regards as desirable opportunity for the incompetent.

Although Professor Bagley is on the whole somewhat disappointed in the outcomes thus far obtained from the measuring movement, there is one point at which he gives it hearty endorsement, for it shows up the vagaries of the theory and practice of Progressive Education. Unlike the proponents of the progressive schools, he is quite sure that whatever it is which tests measure is something of fundamental importance, and something which tests show pupils in progressive schools do not learn as well as the pupils of the traditional schools. He scores the progressive schools for their lack of organized programs, their dependence on present needs and interests of pupils and their failure to discipline them, in the sense of giving them ability to concentrate on difficult tasks.

Such is the general position which Professor Bagley takes in relation to what may be regarded perhaps as the three major movements in American education to-day, but it would not be doing justice to his treatment if these views were not projected on the background of evolutionary theory which he adopts—a theory which "is particularly helpful because it affords a rational escape from the fetters of a mechanistic materialism and determinism." Man's place in nature can best be understood when he is regarded as the latest and highest product in a progressive series of emergent forms and corresponding functions. These emergent forms which are discontinuous with preceding forms, inasmuch as their qualities and functions are different, appear in the organic world but especially in the biological series. Mind is an especially important emergent form in this series.

Man is a major emergent in the animal series and is unique mainly because of his ability to learn, and to transmit the results of learning to later generations. The main purpose of education is the transmission of this social heritage in the form of knowledge, skills, ideals and atti-

tudes. Of especial importance is the emergent volitional trait which transcends the primitive level of conduct determined by mere pleasantness and unpleasantness, and becomes "the ability to act or to refrain from action without the bribe of primitive pleasure or fear of primitive pain."

Professor Bagley has been accused of never having made "a complete declaration of faith."[2] Perhaps *Education and Emergent Man* may be regarded as an attempt to answer this charge. He reiterates his faith in eternal verities for "although new configurations are unpredictable . . . it does not follow there are no permanent or at least relatively permanent elements of culture." Religious sanctions are effective even though they are denied as in the case of Russia. Education should be a stabilizing force through its disciplinary office and especially in periods of rapid change. Professor Bagley refuses to take a definite stand in regard to communism and capitalism. He is content to point out the dangers of each. He accepts the machine-slave stage of social existence which we have now reached, and, taking the long time view, looks for an emergent social organization which will mark progress, provided education in the meantime has done its part in conserving the "eternal verities" of the social heritage. These values are in grave danger because of the influence of the prevailing pragmatic philosophy of education.

University of Illinois E. H. CAMERON

DOUGLASS, HARL R., AND BOARDMAN, CHARLES W. *Supervision in Secondary Schools* (New York: Houghton Mifflin Company, 1934), pp. XVI + 564.

The latest volume on the supervision of secondary schools devotes two chapters to secondary schools and twenty chapters to supervision. This sounds like a criticism but should not be so regarded. The great bulk of research and writing on supervision has been in the field of the elementary school. Those interested in secondary schools have for long been looking for a text dealing with supervisory problems in their field. Several volumes have appeared lately dealing with secondary supervision but each of them turns out to be a treatment of general supervision with incidental references to the secondary school. As indicated, the newest addition to the literature faithfully follows this precedent. The only exceptions to this type of presentation, in fact, are the one or two books dealing with the supervision of secondary subjects.

The situation would seem to bear out the contention of a few leaders that the problems and principles of supervision are the same from kindergarten to college. There will be variations in application due to typical differences in the school levels—age of children, training of teachers, form of organization, type of curriculum, etc. The fundamentals, however, remain the same. Supervisory officers therefore should be thoroughly familiar with the nature of the school level at which they work and conversant with the fundamentals of supervision. The specific applications and adaptations are made by competent workers on the spot. There is no "elementary" or "secondary" supervision.

Douglass and Boardman open with a chapter on supervision in the secondary schools which is an excellent treatment of the need for supervision, the obstacles in the way, and the ultimate contribution to be made. The chapter, with the change of a few foot notes would apply as well

[2] Woelfel, N. *Molders of the American Mind* (New York: Bureau of Publications, Teachers College, Columbia University, 1933), p. 165.

to elementary schools. Chapter 4 deals with the principal and the department head as supervisors and is the most important chapter for orienting the book in the secondary field. The remainder of the volume is a well written, readable, teachable summary of general principles and techniques of supervision.

Part I summarizes clearly and logically the functions and organization of supervision. It is quite similar to and follows present texts in the field. Part II presents the various standardized and traditional techniques of supervision; visitation and conference, measurement of efficiency, demonstration teaching, etc. A chapter on research seems logically out of place here. This chapter is the only seriously weak discussion in the book, being abstract, formal, and not well organized.

Part III includes "supervisory services" such as assisting teachers with improving materials of instruction, giving and using tests, adapting to individual differences, etc. Most of these are not essentially different in nature from the items in Part II. One or two chapters seem out of place. Part IV contains one chapter on the training and personality of supervisors.

The present reviewer recognizing the need for so-called "practical" books, for the present at least, refrains from making a criticism which some reviewers are certain to make with considerable severity, namely that the book makes no contribution to theory and practice. It is, they will say, a faithful, imitative, reproduction of current thinking. A point of view has been accepted, a sound one, around which research studies and practical discussions have been grouped in support. There is little or no critical discussion of any point, such as for instance appeared in the vigorous and stimulating opening chapters of the volume by Alberty and Thayer.[1] By contrast the present volume is strong where the Alberty and Thayer treatment was genuinely weak, namely in the explicit discussion of routine techniques through which supervision is carried on. Apart from this one point, probably no other major criticisms will be offered. A few very minor weaknesses in logical arrangement of chapters and materials may be noted. The volume supersedes other general volumes in that it brings up to date the discussion of the standardized techniques of supervision. The recent investigational and discussional literature is well summarized and judiciously used. The book is not for research students preparing to make critical attack upon supervisory procedures but is a compendium of practice for workers in the field. As such and as a text in training classes the book deserves and doubtless will have very wide use.

W. H. Burton
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Driscoll, Gertrude Porter. *The Developmental Status of the Preschool Child as a Prognosis of Future Development.* Child Development Monographs, No. 13 (New York: Bureau of Publications, Teachers College, Columbia University, 1933), pp. XIV + 111.

Determining status and predicting behavior have been focal points of research efforts in child development. Any study which provides new techniques or evaluates existing procedures is welcomed by individuals engaged in the training of children. This treatise concisely evaluates two mental tests and presents a combination of developmental indices which predicts future success of preschool children.

[1] Alberty, H. B., and Thayer, V. T. *Supervision in the Secondary School,* New York: D. C. Heath and Company, 1931.

The reliability of the Kuhlmann-Binet and the Merrill-Palmer tests is considered in the first part of the monograph. Retests were made at intervals of six to twenty-four months on 205 children. Reliability coefficients from .47 to .76 indicate relatively low predictability for these tests. Serious errors would result if future development of preschool children were predicted from IQ's alone. These two tests correlated with each other at a two weeks interval as high as the reliability of either of them at a six months interval.

There was a tendency for IQ's on retests to be higher than they were on the initial test. Children made a better showing on the Kuhlmann-Binet than on the Merrill-Palmer test. There were no significant sex differences.

Part II of the discussion is devoted to a follow-up study of 50 children who were retested after an interval of at least four years. A combination of five indices, mental development, special abilities, physical development, stability, and personality adjustment, gave a prediction about 10 percent more accurate than predictions from IQ's alone.

The first part of the monograph though brief is of more value than the proposed method for improving predictions by combining developmental indices. The indices considered might more properly have been designated mental abilities, deviations in height and weight, and personality adjustment. It seems optimistic to assume that height and weight give a complete picture of physical development or that mental tests give an adequate clue to special abilities. Developmental indices should be analyzed in more detail before they are combined for predictive purposes.

The writer seems alarmed to find that pupils with superior mental abilities were also above average in height and weight. This finding is in line with the results of other investigators. The reader's attention was not called to the fact that reliability coefficients obtained with homogeneous subjects will be lower than the results obtained with a wide range of abilities. There is an obvious error on p. 20 where D/diff. was written omitting the sigma.

This study should be of particular value to persons interested in mental testing. The attempt to develop a technique for making more accurate prognosis from preschool data is commendable. The results make it apparent that present methods of prognosis are in need of refinement.

CHARLES D. FLORY
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MYERSON, ABRAHAM. *Social Psychology* (New York: Prentice-Hall, Inc., 1934), pp. XV + 640.

Myerson's book, written by a physician and psychiatrist, promises new material and a new point of view. The promise is partially fulfilled. A chapter is devoted to the physiological relations of man and his environment and the dependence of life on the chemical and physical exchange betwen the individual and his animate and inanimate surroundings. This is followed by chapters on the nature-nurture controversy and gregariousness or the basis of man's social nature. Under the title, "Social Psychology of the Nervous System," the chief functions of the nervous system are described. How this physiological description is made to justify the chapter heading may be illustrated by a quotation. "Personality conflict," Myerson says, "is largely a competition for the final common path as a problem of choice. To illustrate it, we may imagine that the stimulus from a visceral organ, say, the gastro-intestinal

tract, impels a man to take some food. But his memory of ethical teaching or of punishment for a past offense against the dictates of society operates to inhibit the impulse. Struggle ensues within the organism; the visceral stimulus seeks to route into action the motor mechanism of the organism, but the frontal lobe, or some such part, tends to inhibit this visceral urge. Choice then must take place. And the conduct resulting may be governed by the visceral urge or by its inhibition, or may be conduct of a compromise type."

In this chapter much is made of the role of excitement and thrill in the determination of human interests and human relations. Unfortunately this very promising discussion does not quite reach its goal because the author has no adequate statement of the circumstances which determine excitement or of the manner in which thrill influences learning and habit-formation. He is contented with a description of some of the visceral components of excitement and with the statement that "the cortex, so to speak, seeks its own satisfactions by bringing about the activities of the autonomic nervous system."

The treatment of instinct follows McDougall with reservations. "As the individual develops through maturation and through his conditioning by teaching and by the experiencing of the results of acts, these primitive responses become elaborated into parts of purposes which are conditioned by the forebrain activity, and which thus become linked up with what we call intelligence."

The treatment of play is conventional. The infant's first play "is a searching for acquaintance with the qualities of the realities around him." Its direction is determined by pleasure and excitement.

Thinking (which the author believes is the despair of the behaviorists) is at first automatic and associative. It later becomes directed and controlled into organized goal-seeking. Neither the laws of association or the nature of the later direction are discussed.

The second part of the book is called Visceral Social Psychology. It deals with the functions of the gastro-intestinal tract, the circulatory system, and the sexual functions, with interesting and illuminating comments on the role these play in social behavior. Part III and Part IV deal with the social psychology of the family and misdoing, one chapter to each.

As a new systematic account of social psychology Myerson's volume opens new sources of explanation of human social behavior in physiological determiners of behavior. It does not offer any adequate notion of learning and makes very little use of the Thorndikean theory which is briefly described. It furthermore uses such inadequate explanatory concepts as imitation, sympathy, emulation, identification, exhibitionism, partisanship, and the like. Such terms should not be used in explanation of behavior without analysis. Men do not regularly act in these ways, and the understanding and proper use of these terms demands that we know the circumstances under which these modes of behavior appear and the circumstances under which they fail to appear.

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PALMER, IRENE. *Tests and Measurements: A Workbook in Health and Physical Education* (New York: A. S. Barnes and Company, 1932); pp. XI + 143.

This book is less a "workbook" than a notebook and list of reading assignments and exercises. The first eight chapters (42 pages), devoted to the "Tools of Measurement," offer a brief, elementary presentation of statistical meth-

ods through simple correlation. The following nine chapters (65 pages) consider general criteria for the evaluation of tests; the three-point and the four-point classification plan; anthropometric tests; tests of physical fitness; tests of physical capacity; tests of sensory capacity; tests of motor ability; tests of achievement in physical education; practice tests; tests of knowledge; and tests of attitudes. Suggestions for research and further measurement in physical education take up two chapters (7 pages). A "Final Review" (in the form of an objective test), a bibliography of six pages, and a glossary of 110 terms, complete the book. There is no index.

This book undoubtedly fills a need for a brief work on statistics and measurement, adapted to students of physical education. From a scientific point of view, it seems unfortunate that the author did not see fit to adopt a more quantitative and critical attitude toward the specific tests which she describes. Perhaps, however, in a field of measurement still young and undeveloped, an attitude of tolerance is more likely to lead to immediate progress.

A few minor errors or obscurities should be mentioned. Thus, on p. 32, the expression $\left(\frac{S\ f\ d}{N}\right)^2$ is misprinted as $\left(\frac{S\ f\ d^2}{N}\right)$. On page 34, the tabulations given as examples of perfect positive and negative correlation, would not, upon computation, yield r's exactly equal to +1 and —1, respectively. On page 39, Henry Garrett is re-named "Harry" Garrett. Occasionally, technical terms have been introduced before their meanings are adequately discussed (e.g., "normal curve," on page 23, and the "physical constants of the human body," on page 48). On page 51, the word "exponent" is used in place of the more appropriate term "score," or "weight." The author's recommendation, on page 97, that true-false questions administered with "Do not guess" instructions should be scored by the "No. Right" formula, is of very doubtful validity. On page 98, the implication that three-choice tests are inherently unreliable, is surely in error. It is, in brief, clear that the author of this book is not an expert either in statistics or in educational measurement. For all that, however, she has written a useful little handbook of tests and measurements, from which students of physical education may learn a great deal.

HERBERT S. CONRAD
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WALKER, HELEN M. *Mathematics Essential for Elementary Statistics: A Self-Teaching Manual* (New York: Henry Holt and Company, 1934), pp. XIII + 246.

Teachers of elementary statistics have all had the experience of suggesting simple mathematical books to students who need additional information or review of the mathematics necessary for statistical method. The result of these suggestions is usually unsatisfactory because the material is scattered widely over a number of courses and topics and the student does not obtain a simple coherent account of what he needs.

Dr. Helen Walker has done an excellent service for such students in her book on *Mathematics Essential for Elementary Statistics*. This book begins with simple arithmetical operations and decimals and covers a well selected number of topics in algebra. Chapters in Symbolism on Statistics, Symmetry and Homogeneity of Algebraic Expressions and The Normal Curve are also included. The topics appear to be very well chosen.

The book is clearly written and arranged in pedagogical form. At the beginning of each chapter is an initial test to see if the student understands the topic therein. Explanation, rules and

illustrations follow and at the end there is usually a second check-up test.

The reviewer thinks this is an excellent and useful book, but the opinion of the students for whom the work was intended is of more importance. With this in mind he asked a number of students, some with much and some with little mathematical training to read portions and write a reaction to the material read. These reports were nearly all highly favorable. The students found the material generally clear, practical and helpful. They felt the book was written for students and not teachers of mathematics, which is most rare, and any minor departures from vigor, negligible. Teachers and students alike will then be most thankful for this book.

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BROWN, RALPH. *Mathematical Difficulties of Students of Educational Statistics.* Contributions to Education, No. 569 (New York: Bureau of Publications, Teachers College, Columbia University, 1933), 66 pp.

This and Helen Walker's *Mathematics Essential to Elementary Statistics* are an admirable pair of books on the topic of the mathematical background requisite to elementary educational statistics. Brown has reviewed the mathematical concepts and skills which are demanded by the most commonly used textbooks in the field and then investigated the extent to which these particular skills gave difficulty to the students enrolled in courses in educational statistics.

Brown's study is divided into essentially five parts: (1) mathematical concepts and skills; (2) computational difficulties; (3) other mathematical difficulties; (4) mathematical ability; and (5) the relationship of mathematical ability and success in statistics.

According to this study the following are the most frequent of the fundamental computational manipulative skills: imitate a model exercise, place a decimal point, evaluate a formula, read values from a table, find a square root, work from a computational job sheet, operate with negative numbers, observe the conventional order of operations, compute with numbers arranged horizontally, select the appropriate formula and technique. The major sources of computational errors seem to be in "lapses," such as forgetting to carry a figure, writing digits in changed order, and so forth. Negative numbers seem to be a source of error. Mixing up the order of operations, understanding of cancelling terms in the numerator and denominator of a fraction, correct placing of the decimal point, reading a table in reverse direction, and so forth, seem to be the sources of error which are most typical and errors of the type which can, with very little training be obviated. These more strongly emphasize the necessity of adequate checking formulae.

For, while there is some relationship between training in mathematics and success on tests, the evidence does not suggest that the relationship is a causal one.

As a result of this study, it seems that a brief training in fundamental and simple mathematical processes would be profitable. The possibility of a high school course in statistics is suggested. For most students taking elementary statistics, a shift in the nature of the course from less of a mathematical statistics to more of an interpretative statistics seems to be needed.

The study is essentially one of finding facts to form the background to answer the questions regarding course organization of educational statistics, mathematical prerequisites, remedial or reinstruction in mathematics, and similar matters.

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RESEARCH NEWS and COMMUNICATIONS

Address all research news and communications to Carter V. Good, Teachers College, University of Cincinnati, Cincinnati, Ohio.

Carnegie Foundation.—The annual report of the Carnegie Foundation for the Advancement of Teaching for 1934 includes an account of a coöperative arrangement between Carnegie Corporation of New York and the Foundation, beginning in 1921, whereby the sum of $544,600 has been devoted to more than forty educational research projects. The grants made for this purpose have varied in amount from $400 to $83,000.

During the same period, grants from the Corporation to the Foundation for studies of its Division of Educational Inquiry have totaled more than $205,800, in addition to grants made through the Foundation. The largest sum granted by the Corporation to the Foundation for a study carried on by the latter was, up to June 30, 1934, $136,500 devoted to the Foundation's Pennsylvania study. The Division of Educational inquiry was originally established in 1913 by a grant of $1,250,000 from the Corporation.

Although the report includes no direct attempt to evaluate the results of any grant made, it is maintained that the amount of money devoted to a project bears no relation to the values of the results obtained. "The factors of timeliness and of personnel in the research or other work appear to be more important than the size of the grant. Preliminary planning and definition of problems and of scope are of great importance. Not infrequently it has appeared that the greater the time and effort put upon these matters early in the life of a project the more fruitful the result. Moreover, it appears to be a general rule that research which is already conceived, planned, or even under way prospers better under a grant than research that must be stimulated by money to initiate, even in the hands of very expert workers."

"Policies governing the making and administering of the grants have developed from the exigencies of each case rather than been framed in advance. This method of trial and error, if such it may be called, has been advantageous in securing breadth, flexibility, and timeliness of the general program. Above all, it has helped to remove from the Corporation or the Foundation any possible stigma of propaganda or self-seeking.

"Finally, grants are likely to be most fruitful if, at the time of initiation, ways and means of publishing and distributing results receive due consideration."

Commonwealth Fund.—The services and activities of the Fund involve total appropriations amounting to $1,720,514.54 in the past year. Of this sum, 58.6 percent (the largest share in any recent year) was devoted to enterprises aimed directly or indirectly at the betterment of American health. This includes the Fund's own hospital and public health projects and health studies, contributions to medical education and medical research, and some isolated public health services. The British Fellowships took

13.6 percent of the total; mental hygiene activities, chiefly concerned with professional training, 11.9 percent. The remaining 15.9 percent included appropriations for legal research, publications, library service, and the few special grants not closely related to the major fields of interest. The largest item in this general classification is an appropriation of $100,000 for emergency relief in the city of New York.

"Seen in the perspective of a world in turmoil, such resources as those of the Fund may seem insignificant. Scattered, they would be meaningless. Put to the service, year by year, of sharply defined ends—skillful handling of disease, vigorous conservation of health, scientific inquiry into the nature of both disease and health—they may perhaps accomplish something of genuine and enduring value."

General Education Board, 1933-34.—The annual report of the General Education Board gives a record of grants made during the year 1933-34. The income received during that year amounted to $2,498,272.64. Appropriations chargeable to income amounting to $3,028,723.93 were made, an excess of $530,451.29 over the year's income. There were no appropriations made from principal. The report also gives the result of studies in American education conducted by the Board through its officers over a period of nearly two years.

"From 1929 to 1932 the Board gave its support to several projects for the improvement of school and college relationships and for the intensive development of quality in college education. This course of action developed from the belief that the former widespread participation in the plans of American colleges and universities might well be followed by help with certain basic problems constantly before them. Through aid to institutions and to educational commissions there were studies made of the accrediting, examining, and teaching procedures in force at a number of representative institutions and within large areas of the country. At a few places controlled experiments were carried on by the college administrative officers and staff having the responsibility of selecting students and of organizing courses of study for both schools and colleges. Regional agencies were assisted with studies of school and college relationships, with new definitions of standards, and with plans to give individual students special courses of study for the development of their aptitudes and interest. Such projects have been of benefit to American education by demonstrating desirable changes in the existing routines. Their effects are evident in colleges and universities, and further investigations of the same nature will doubtless continue. The Board now believes that its defined program for the improvement of college education is relatively less important than was the case five years ago. It therefore will participate in plans for new investigation and experimentation in that area only as may be desirable for the advancement of some phase of its existing program.

"The first phase of work presented in the report is that for the improvement of general education. A definition of general education is given through the statements regarding its objectives offered by many of the persons invited to participate in the Board studies; several of the participants have given public expression to the opinions offered in their reports through the publication of books and journal articles that have had wide circulation. These critics of educational

practice today asked for new purposes rather than for further modifications in existing routines. They called in question the present objectives of what is commonly called secondary education. It was pointed out that too little has been done to discover a form of education universally useful to man in society today; that by formal or informal methods every individual should be made familiar with the forces that he will encounter in daily living; and that apart from special preparation for earning a livelihood he should be made ready for continuous participation in the responsibilities and satisfactions of life to the extent of his individual ability. Many competent critics believe that the proper time to lay the groundwork of such a general education is within the years of senior high school and junior college; yet all agree that a clear definition of objectives must precede the trial of the plan in any formal setting. This they consider primary in any plan for far-reaching reform. The purposes of a general education for individual and social usefulness can be stated, they believe, in a way that will have meaning for adults as well as for younger students; the adaptation of methods for its attainment will then be practicable through the processes of formal and informal study. From such considerations the Board reached the conclusion that assistance to the further definition and development of general education through appropriate agencies should be one of the purposes of its new program.

"As the plan for work in this area is in some respects an extension of previous Board interest, so the second phase of the new program, research in child study, represents an outgrowth of activities sponsored by the Laura Spelman Rockefeller Memorial. This part of the plan is directly related to the first, for child study under Board auspices is expected to contribute research results supporting what is done in the field of general education. This expectation had a part in the decision of the Board to approve a limited research program of child study, but another reason of considerable weight was the present lack of continuing studies of child development during the periods of infancy and adolescence.

"As the third phase of its new activities, the Board approved the use of limited appropriations for the training of personnel for the advancement of knowledge. These will be in addition to such sums as may be set aside for similar use under the other three headings of the new plan and are to be in areas contributory to the work of the Rockefeller Foundation within the United States. This interest in the advanced training of personnel for special services of teaching, research, and administration will therefore be directed toward the support of programs of concentration within well-defined fields.

"In its southern program, the objectives of the Board have been modified to some extent within all its long-established services to public and private education. While continuing its aid to state departments of education in their general plans, the Board will bring to a close its extensive program of aid to administrative divisions. Such support has always been granted in the southern states as a temporary measure that would be superseded as soon as possible by permanent support of such work by legislative appropriation. It is hoped that by 1937 all such temporary aid, with the exception of some for service to Negro education will be taken over by the states. Work of the Board in the southern states to be continued with only minor changes

is that for the higher education of both races on a limited basis. Capital grants toward general development have been diminished steadily during recent years, but the improvement of equipment and of personnel for specific services in southern institutions is to be a continuing part of the program.

"Such assistance is a result of definite steps taken by both local and state authorities toward more careful planning of educational services, and by those denominational boards that have supported their institutions in the southern states. One southern regional survey that has continued during the past three years under a Board appropriation shows the usefulness of establishing defined functions for each institution on the basis of past service and present need; within the same period several similar studies have been advancing toward a re-definition of educational means and objectives. The Board will observe with interest all such new points of view regarding educational objectives."

Yearbook of the Department of Superintendence.—The 1935 Yearbook of the Department of Superintendence is entitled *Social Change and Education*, prepared by a committee with John W. Studebaker, U. S. Commissioner of Education, as chairman. The yearbook was discussed at the Atlantic City meeting.

Review of Educational Research.—The December, 1934, number of the *Review of Educational Research*, published by the American Educational Research Association, completes the fourth volume of this valuable periodical. The past four issues of the *Review* are in the second three-year cycle, bringing up to date earlier numbers dealing with "The Curriculum," "Teacher Personnel," "School Organization," and "Psychology and Methods in the High School and College." This means that future numbers must summarize research covering only a three-year period.

Tercentenary of Secondary Education.—The Atlantic City program of the Department of Secondary-School Principals had as its general theme the tercentenary celebration of the development of secondary schools in America. Leaders in this field discussed secondary education: in retrospect, at work today, as an essential factor in a program of national development, in terms of special aspects, and with respect to applying and extending the National Survey of Secondary Education.

Yearbook on the Education of Teachers.—The National Society of College Teachers of Education at Atlantic City presented its yearbook on *The Education of Teachers*. The yearbook committee, under the chairmanship of Thomas Alexander of Columbia University, had the advantage of reading proof sheets of the National Survey of the Education of Teachers. The yearbook committee discusses the principles found in the National Survey with which it agrees and certain other principles with which it disagrees.

Yearbooks on Materials of Instruction, Rural Education, and the Teacher's Health.—The 1935 or Eighth Yearbook of the Department of Supervisors and Directors of Instruction, with Fannie W. Dunn of Columbia University as chairman of the committee, deals with *The Materials of Instruction*. The 1935 Yearbook of the Department of Rural Education, with Mable Carney of Columbia University as editor, is entitled *A Pro-*

gram of Training for Teachers in the Smaller Rural Schools. The 1935 or Ninth Yearbook of the Department of Classroom Teachers discusses *The Teacher's Health.*

Missouri Studies. — Investigations of the "Reading Habits and Interests of Adults" and of "Original Interests and Mortality" are being conducted by Eugene S. Briggs, State Director of Adult Education for Missouri. In the first study a sampling of one out of each five hundred people in the state is being interviewed.

Child Welfare Pamphlets.—The Iowa Child Welfare Research Station at the University of Iowa is publishing a series of bulletins entitled *Child Welfare Pamphlet* in an attempt to give parents and others the results of scientific studies in this field, presented in popular and readable form. The series now includes 45 numbers at five cents each.

Inglis Lecture, 1935.—The current Inglis Lecture, entitled *The Care of the Pupil,* was delivered by Samuel S. Drury, Rector of St. Paul's School. This is the first lecture of the series delivered by a representative of the private secondary-school group. The sequence of the preceding numbers includes Koos, Hanus, Flexner, Judd, Counts, Briggs, Dewey, Learned, Morrison, and Kandel.

Dictionary for Children.—The new school dictionary, by E. L. Thorndike of Columbia University, is based on some twenty-seven years of research in the field of children's understanding and use of words. It is intended for elementary-school pupils between the ages of nine and fifteen, and includes 25,000 of the most commonly used words, as determined by examination of some ten million words. The title is *Thorndike Century Junior Dictionary,* published by Scott, Foresman and Company.

Studies of Librarianship.—A new series, Peabody Contributions to Librarianship, edited by Louis Shores, Director of Peabody Library School, includes the *History of School Libraries in the South,* by Margaret I. Rufsvold; *Periodical Checklist for a Teachers College Library,* by J. I. Copeland; and *Non-Professional Library Instruction in Teachers Colleges,* by Mabel Harris.

New Publication in Psychology.—*Acta Psychologica* is to be an annual volume, contributions to which may be published in English, French, or German. The editor is G. Révész of Amsterdam. No. 1 includes 23 lectures delivered during the Tenth International Congress for Psychology at Copenhagen in September, 1932.

Reorganization of Secondary Education.—The February 11, 1935, number of the *News Bulletin* of the Society for Curriculum Study contains a preliminary report of the Society's Committee on Secondary Education. The Committee hopes to write, analyze, and publish a number of outstanding curriculum plans for the reorganization of the American high school. The chairman of the committee is Samuel Everett of Lincoln School, Teachers College, Columbia University.

Directory of Secondary Schools for Negroes.—Occasional Papers, No. 29, of the John F. Slater Fund, is a complete list of all public schools for negroes in the southern states that offered any in-

struction at the secondary level, as of October 1, 1933. In 1911 there were in these states fewer than 50 public schools for negroes offering any secondary work. Since that time the Slater Fund has aided 612 such schools to the extent of $1,216,475.

Conference on Social Planning.—The Summer Institute for Social Progress at Wellesley, Massachusetts, a unique venture in economic education, will hold its third annual session July 6th-21st on the campus of Wellesley College. Each year an effort is made to attract men and women with a great variety of practical knowledge and experience to apply, and from the list of applicants 130 are chosen in order to keep so far as possible a balanced representation from all of the occupations. This membership scheme makes the cross-section discussion groups decidedly realistic and the exchange of conflicting experiences and opinions practical and stimulating. "Social Planning in an Age of Conflict" will be the theme for this year's conference, and the program will consist of lectures, cross-section discussions, and open forums under the leadership of able economists well versed in leading discussion.

Conference on Business Education.—Special emphasis will be given to the money problems of the individual at the Third Conference on Business Education, to be held at the University of Chicago on June 27 and 28, 1935, under the auspices of the School of Business. "Business Education and Money Management" will be the general topic discussed.

Guidance and Personnel Organizations.—The American Council of Guidance and Personnel Associations, organized in the spring of 1934 to coördinate and unify the work of national societies concerned with educational and vocational adjustment of American youth, held its first annual convention at Atlantic City in February.

During the past several years, various national groups active in this field have realized that despite differences in their names and histories, they had similar aims. Hence, the suggestion arose that closer coöperation would benefit each organization. Aided by the Carnegie Corporation, eleven of these national groups have banded together under the name of the American Council of Guidance and Personnel Associations.

Organizations comprising this Council include: American College Personnel Association, Institute of Women's Professional Relations, National Association of Deans of Women, National Federation of Bureaus of Occupations, National Vocational Guidance Association, Personnel Research Federation, Southern Woman's Educational Alliance, and Teachers College Personnel Association. In addition to the active membership, there are three affiliated organizations: American Association of Collegiate Registrars, National Federation of Business and Professional Women's Clubs, and Eastern College Personnel Officers. Four of these associations held their annual meetings at Atlantic City in addition to participating in the program of the Council.

Testing and Guidance in Providence, Rhode Island.—Providence uses an interesting and thorough program for examining and rating candidates for teaching positions. Every candidate should possess certain broad educational qualifications including general culture, scholastic aptitude, and professional preparation. All candidates must take objective examinations in these fields. In addition,

each candidate should be a master of at least two subject fields of instruction in the curriculum of the public schools and through objective examinations must demonstrate scholarship in these fields sufficient to justify his appointment to teach them. The result of each of these five examinations is translated into a percentile rank, indicating exactly where the candidate would rank in a group of one hundred teachers. These percentile ranks are added and the total examination marks count a possible 500 points out of a total of 1,000.

Of the remaining 500 points, the 200 which evaluate training and experience are also impersonal and objective, since they are determined by a scale of values and are based upon a questionnaire which each candidate files by number without his name attached. Thus, 700 out of 1,000 points are determined on the basis of examination and facts, all of which may be reviewed and challenged by the candidates, without involving the names of the candidates.

The remaining 300 points represent "a group rating in teaching personality." The rating is made by a group of principals and assistant and deputy superintendents who determine the relative desirability of each candidate as a member of a school faculty, as a wholesome influence with growing young people, and as a positive asset in the life and work of the school. A relative rating on personality is spread on a 300 point scale and added to the ratings on experience, general qualifications, and special qualifications, to obtain a grand total score. When the candidate has been trained in the local schools, the record of training is a very important part of rating.

Providence is experimenting with a new technique of group guidance in which new-type tests of achievement, abilities, interests, attitudes, and adjustments are used as laboratory materials with which pupils measure themselves. No one knows the result except the pupil himself, but the general implications are discussed in class, individual questions answered, and the pupil is led to see himself in the picture where his score places him. The course is conducted by the class counselor in the junior and senior high schools. The method is described and the materials appear in a manual published by the Inor Publishing Company, New York City, under the title "Self-Measurement Projects in Group Guidance." There are seventy-three counselors in Providence who are using these materials. A study of the effect of such projects upon the attitudes of pupils regarding their own educational problems is under way.

The secondary schools in Providence are definitely embarked on the program sponsored by the Educational Records Bureau of New York, which provides for the use of the Coöperative Tests in all college preparatory subjects and the keeping of cumulative records of growth as a basis for individual guidance and adjustment. This is the third year of the project and principals, teachers, and administrative officers are enthusiastic about the program.

Richard D. Allen is in charge of the Department of Research and Guidance.

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